

MEMOIRS

OF THE

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INTRODUCTION

SETTING THE SCENE

The story that unfolds in this monograph was influenced by two main factors. The first is an archaeological observation. Prior to commencing this project, we had noticed major regional differences in the rock paintings of various parts of north Queensland. Most of these paintings did not appear to be very old. The archaeological excavations undertaken in the region until then had all revealed major cultural changes during the mid to late Holocene period (i.e. last 3,500 years or so). In particular, new artefact types, and increases in the deposition rates of cultural materials (including ochre) were apparent at that time. It was felt that these two issues — the geographically regionalised cave paintings and major cultural changes of the mid to late Holocene — may have been connected.

The second factor stems from our chosen theoretical position. We felt that the structure of the archaeological record may be related to social practice, including social and territorial organisation. Furthermore, if social change affects — or is affected by — social structure, then patterns of change and stability in the way the archaeological record is organised may have bearing on those of prehistoric socio-cultural phenomena. For instance, the nature of inter-regional relations, from say around 5,000BP, may have affected inter-personal relations in any single place at that time. If aspects of human interaction could be investigated archaeologically, important clues may be gained into the dynamics of social systems in north Queensland prehistory.

This work therefore stemmed from our suspicion that the archaeological patterns of north Queensland may indicate major changes in inter-regional interaction during the mid to late Holocene. Our main aims are therefore to systematically investigate these apparent archaeological trends, and to explore the possibility of investigating archaeologically the dynamics of inter-regional relations in north Queensland prehistory.

INTRODUCING A PROBLEM

Until recently, Australian Aboriginal social and political systems were characterised as essentially static. This involved a lack of consideration of both short-term social processes and longer-term

trends in Aboriginal prehistory (Cleland, 1966). There were two general exceptions to this viewpoint. Firstly, changes were generally acknowledged to have taken place when one people or culture replaced another (migration), as expressed by changes in stone artefact types within excavated sites (Hale & Tindale, 1930; Hossfeld, 1966; Wunderly, 1943; Birdsell, 1967). And secondly, change was also acknowledged where external contacts, such as the arrival of Macassans during the last few hundred years, produced cultural innovations (diffusion) (McCarthy, 1943).

By 1962, the view of Australian Aborigines as 'simple', 'egalitarian' and 'culturally undeveloped' was still a dominant theme among non-Aboriginal Australians. Manning Clark's first volume of his encyclopaedic 'A history of Australia', acknowledged as one of the classic works of Australian history and still widely used as a historical text, introduced Australian history in the following way: '*Civilization did not begin in Australia until the last quarter of the eighteenth century. ... The early inhabitants of the continent created cultures but not civilisations. ... A distinction is made here between 'civilization' in the sense described in the Oxford English Dictionary, of a people brought out of a state of barbarism, and 'culture' in the sense defined in the Grosse Brockhaus as the sum of the efforts made by a community to satisfy and reconcile the basic human requirements of food, clothing, shelter, security, care of the weak and social cohesion by controlling its natural environment.*' (Clark, 1962: 3).

Such views were based on an assumption that change was slow (if present at all) and driven largely, if not entirely, by external forces. As Rowley (1986: 4) notes, '*... for lack of historical background, the Aboriginal community is treated as a more or less static society*' based on notions of intrinsic stability. An example of this was Professor J.B. Cleland's preface to 'Aboriginal man in south and central Australia', where he declared: '*At the coming of the white man the Australian aboriginal was in equilibrium with other members of the fauna to which he belonged and fitted naturally and, on the whole, very successfully into his environment.*' (Cleland, 1966: 3).

Treated thus in a synchronic framework and frozen in time, Aboriginal societies appeared to show little evidence of internal dynamism, espe-

cially when compared with other indigenous cultures.

Such views dominated Australian archaeology throughout the first half of the 20th century. McCarthy (1964) questioned those who interpreted changes observed in the archaeological record in terms of migrations, but he continued to propagate the idea that external influences were responsible for the main changes observed in the sites he investigated. For instance, he argued that in the Capertee Valley, N.S.W., *'the introduction ... of the Bondi point, geometric microliths, elouera, gum hafting, the elaboration of the burin and later the introduction of the ground edge axe, and the working back of adzes into discarded slugs, indicates contact with an important stream of culture diffusion whose direction is not yet known. ... I prefer to regard these changes as being due to diffusion rather than to new waves of Aboriginal people.'* (McCarthy, 1964: 239).

There was little acknowledgement of the possibility that Aboriginal society had (or could have) changed by the weight of internal forces.

FROM STABLE TRADITIONS TO DYNAMIC SOCIAL SYSTEMS

It was customary also to view the Australian Aboriginal past as consisting of a series of distinct episodes of prehistory, each observable archaeologically as distinct and relatively discrete sets of material artefacts (Hale & Tindale, 1930; Gould, 1977; Mulvaney, 1975). For example, the early Core Tool and Scraper Tradition was seen to consist of large artefacts often characterised by steep edges and percussion flaking. This was followed by the Small Tool Tradition which, among other things, heralded the beginnings of pressure flaking, blade technologies, and a broad suite of new artefact types. Each tradition was treated as an essentially coherent system of artefact production and use (cf. McCarthy, 1964; Mulvaney, 1975; but see Lampert, 1981).

In the late 1970s and early 1980s, a dissatisfaction with culture-historical approaches to Aboriginal prehistory began to appear in the literature (Hallam, 1977; Hughes & Lampert, 1982; Lourandos, 1980a, 1980b; McBryde, 1978; Jones, 1976, 1978). This dissatisfaction stemmed from the failure of these approaches to address issues concerned with the dynamics of socio-cultural systems and of change. This problem, to a large extent, also reflects the influence of Radcliffe-Brown's work (and the largely ahistorical emphasis of the British structural-

functionalists in general) on socio-cultural anthropology and Australian archaeology. It also highlights a tendency, which has prevailed among Australian archaeologists, to treat prehistoric Aboriginal systems as ecologically adaptive and therefore subject to external influences, while ignoring the role that internal (socio-cultural) relations have played (Bird & Frankel, 1991; Flood, 1983). By identifying normative behaviour, and by treating change as a more or less mechanical response to environmental circumstances, little inquiry was made into the internal social forces influencing material and structural dynamics. Culture-historical approaches were largely employed at the expense of an understanding of forces of stability and processes of change in Australian prehistory.

The 1970s witnessed a major re-orientation in the ways that Aboriginal prehistory was characterised by Australian archaeologists (largely due to a major diversification in approaches to Australian prehistory). Cultural ecological approaches began to address the role of local environmental factors to socio-cultural change in a more sophisticated fashion (Jones, 1968), but again internal social processes were largely ignored. Such ecological approaches took various forms, but were perhaps best epitomised by Yengoyan's (1976) view that the Aboriginal systems observed ethnohistorically had developed as a response to adaptive needs. As such, they were considered optimal for the situation at hand. An example of this is his treatment of the eight-class system as a logical and almost necessary social solution to the exigencies and uncertainties of resource poor, arid ecological conditions. Such approaches usually treated social strategies as outcomes of external environmental circumstances (epiphenomena). When adaptive processes were discussed, the terms of adaptations were rarely defined. Existing social strategies were, to a large extent, treated as static and beneficial, and socio-cultural factors were rarely seen as a force in socio-cultural dynamics (but see Jones, 1978).

It was not until the end of the decade that systematic discussions of the latter kind, concerning Aboriginal socio-cultural dynamics in prehistory, emerged (Bowdler, 1981; Hughes & Lampert, 1982; Jones, 1978; Lourandos, 1977, 1980a, 1980b; Morwood, 1979) (see below). Viewed, therefore, in a new light, Australian archaeological records were largely re-interpreted with regard to their internal dynamics, rather than as products of social stasis. Indeed, it could be argued that our understanding of broad trends in

Australian prehistory has gone little beyond the discussions initiated in the early 1980s, although specific details have proliferated. In this sense, the present work stems from debates concerning archaeological patterns of change and stability established in the literature a decade ago; patterns which have unfortunately received inadequate attention in the interim, but which warrant considerably more exploration. Furthermore, attempts to investigate the dynamics of Australian prehistory have almost exclusively concentrated on changes in artefact and site types and deposition rates of archaeological materials within sites. Investigations of the dynamics of the structure of past socio-cultural systems are largely non-existent. This is an important point, as it could be argued that social dynamics are most clearly expressed in structural phenomena.

The starting point for this work is three particularly important contributions to Aboriginal prehistory. The first is Maynard's (1976, 1979) conclusion that Australian rock art possesses both spatial and temporal patterning. In particular, she argued that the earliest rock art from most, if not all, parts of Australia were dominated numerically by non-figurative (non-iconic) and track motifs. This relatively homogeneous artistic tradition was followed in some regions by a number of different styles. Although some of the specific details of Maynard's model need to be refined (e.g. she divided the later 'styles' into two general groups, 'simple' and 'complex' figurative), her general observation that the earliest rock art was widespread has still not been falsified.

The second major work that influenced our own research is Morwood's (1979) research in the Central Queensland Highlands, where he argued that chronological changes in rock art appear to be contemporaneous with changes in other aspects of the archaeological record. By using rock art as an integral part of the archaeological record, and analysing it in a way similar to that for stone artefacts, Morwood convinced the Australian archaeological community that the former was amenable to archaeological enquiry. Until then, rock art was rarely treated as such by Australian archaeologists (Maynard [1979] was an exception). In this way, our research in north Queensland stems from the legacy of Morwood's pioneering work.

The third important work was an influential paper by Lourandos (1983; see also Lourandos, 1980a, 1980b). Lourandos argued that the Aboriginal past should not be treated as inherent-

ly static, for in our investigation of long-term time frames, we gain access to regional social and cultural dynamics amenable to archaeological investigation. He argued that during the last two millennia or so, Australian prehistory witnessed what appeared to be unprecedented changes, and that these changes could only be properly understood by considering them in relation to changes in Aboriginal social, economic and political organisation. Lourandos's overview of Australian prehistory, therefore, centered on social, economic and political dynamics and not simply on models of stability; he argued that Aboriginal prehistory was subject to political processes comparable to those found in what had traditionally been considered more 'complex' societies. In particular, he argued that in many parts of Australia, Aboriginal systems changed significantly during the mid to late Holocene, and that these changes should be viewed in terms of political and social alterations, rather than simply as economic intensification. This was in contradiction to the often stated view that Australian Aboriginal societies were based on egalitarian principles, where change was slow and generally of little significance.

Although some of Lourandos's arguments had been pre-empted by others (Bowdler, 1981; Hallam, 1977; Hughes & Lampert, 1982; Lampert & Hughes, 1974), it was not until the intensification paper was published that internal social forces began to be incorporated systemically within studies of change and stability in Australian prehistory. Considerable attention has been given to these issues more recently, and a major debate has erupted, focusing on the nature of the paradigms and models guiding Australian prehistory (Barker, 1991; Beaton, 1983, 1985; Bird & Frankel, 1991; Bowdler, 1981; Cribb, 1986; David, 1987; Flood et al., 1987; Frankel, 1991; Head, 1989; Jones, 1985; Lourandos, 1984, 1985a, 1985b, 1991; McNiven, 1990; O'Connor, 1992; Ross, 1985; Ross et al., 1992; Rowland, 1983; Williams, 1988; Yoffee, 1985). Inevitably, such debate has led to a split among academic researchers as to whether or not the documented archaeological changes indeed suggest socio-cultural changes, or whether they should be viewed through other interpretative frameworks. But, as Rowland (pers. comm., 1993) has commented, the intensification arguments forwarded by Lourandos in 1983 were critical to the development of Australian prehistory, not solely because of his specific explanations of the archaeological patterns, but also because of the general paradigm

through which he viewed Australian prehistory (based upon socio-cultural dynamics, not just stability) (see also Huchet, 1991).

THE PROBLEM

Despite the fact that Lourandos's 1983 paper focused on the significance of socio-political organisation as regards prehistory, few researchers have attempted to investigate changes in the structure of the archaeological record. We still do not know whether the changes advocated by Lourandos and others (e.g. Flood et al., 1987) involved a major reworking of social networks over a short period of time, or whether, in essence, they involved innovations undertaken within the context of social and political systems that have remained relatively stable over longer time frames.

By the time we began the research for this study, a major debate was thus already full-blown in the Australian literature, focusing on the dynamics of Aboriginal systems in Australian prehistory. While some authors have debated whether Lourandos was right or not, others have concentrated on presenting regional sequences (e.g. Beaton, 1985; Bird & Frankel, 1991; Head, 1989), and on discussing theoretical concerns directly related to the intensification question (Beaton, 1983; Rowland, 1983). Others still have offered critical comments of Lourandos's approach, arguing that due to the shortcomings of the Australian archaeological data, the questions he asked cannot be investigated adequately (Cribb, 1986; Frankel, 1991; Godfrey, 1989; Head, 1989; Rowland, 1983). Thus, after more than ten years of intense examination, the 'intensification debate' remains unresolved, containing large amounts of data and copious viewpoints. Despite some attempts (e.g. Bird & Frankel, 1991), however, it has never been adequately reviewed.

During the last decade, much emphasis has been given to investigating the emergence of new traits and, to a lesser extent, changes in occupational intensities in Australian prehistory (but see Binns & McBryde, 1972; McBryde, 1978; Lewis, 1988; Smith, 1992a, 1992b). While we share the view that such temporal concerns are fundamental to understanding the Aboriginal past, we also consider that not enough emphasis has been given to comparative analyses concerned with the relationship between individual regional sequences. That is, we would argue that by investigating inter-regional patterns, issues directly related to

the interaction of people across space can be addressed. Viewed in a diachronic framework, such investigations may enable us to gain important information on patterns of change and stability in the structure of social networks through time. More specifically, it may also enable us to ask whether or not social and cultural systems changed structurally during the mid to late Holocene, as many archaeologists now assume. Did the observed archaeological changes only involve increases or decreases in the use of sites, artefacts and resources, or did they involve broader changes in the spatial organisation of social behaviour? Indeed, can these two issues be related? Did they involve a change in the way people interacted spatially? Questions such as these have guided our broader concerns here. In asking such questions, we hope to contribute to the issue of, and provide data on, social structural dynamics in Australian prehistory.

INVESTIGATING STRUCTURE IN AUSTRALIAN ARCHAEOLOGY

Few archaeologists have attempted to research the inter-regional structure of the archaeological record in Australia. By structure we mean the way that the archaeological record is organised on the ground — the way its various parts articulate to form a broader whole. Nor have they studied the potential that this may have for a greater understanding of the structure of past social phenomena. Elsewhere, however, major studies of prehistoric inter-regional relations are a relatively common practice. For example, Conkey (1980), Gamble (1982, 1986) and Jochim (1983) investigated prehistoric socio-cultural organisation in Palaeolithic Europe via an analysis of artistic practices, and Gamble (1979, 1983, 1984) researched similar issues by investigating hunting strategies during the same period. The great majority of inter-regional studies, however, have focused on the distributions of stone artefact types, technologies, and traded or exchanged raw materials (e.g. Summerhayes & Allen, 1993; Torrence, 1986).

In Australia, such investigations have been limited as a result of three major factors:

- 1, with the exception of some well known types, such as tula adzes, pirri points and backed blades, stone artefacts have usually been treated as amorphous (Morwood & Trezise, 1989; Mulvaney, 1975; Pearce, 1973, 1974; Smith & Cundy, 1985);

2, specific technological practices have often been assumed to be widespread (but see Allen & Barton, 1989; Hiscock, 1986, 1993); and

3, there is a paucity of easily sourced raw materials on the Australian mainland (but see Binns & McBryde, 1972; David et al., 1992a; McBryde, 1978, 1984).

Together, these three factors have restricted our ability to model inter-regional dynamics on the Australian mainland via an analysis of stone artefacts.

PREVIOUS WORK

A number of important studies on the structure of the archaeological record have nevertheless appeared in Australia. Most of these have concentrated on model-building, and have been based on palaeo-environmental (Birdsell, 1957; Veth, 1989) or ethnohistoric observations (Poiner, 1976). Of those that have been based on substantive, archaeological data, McBryde's research (1978; Binns & McBryde, 1972; McBryde & Harrison, 1981; McBryde & Watchman, 1976) is probably the best known. For many years, she has investigated past inter-regional exchange networks via the sourcing of stone items, principally stone axes, from a series of raw material sources in northern New South Wales and central and western Victoria. In particular, her Victorian work convincingly shows that axes from the Mt William, Mt Camel and Berrambool, Baronga, Geelong, Jallukar and Howqua quarries (central and western Victoria) have been exchanged over considerable distances, at times over 600km from their original sources. Axes from a number of quarries, particularly those from Mt William, have been shown to have been preferentially traded to the north and southwest, with a marked and geographically distinct boundary zone located approximately 150km east of Melbourne. Having identified anomalies in the distance-decay curve (especially in the absence of Mt William axes in eastern Victoria and in the Wimmera/Mallee region), McBryde posits the presence of highly structured territorial networks in the broader region based on the archaeological record, including the presence of at least two major and largely separate interaction networks in central and eastern Victoria. Her interpretations are supported by ethnohistoric records from the region, which document two major and largely antagonistic social groups, the Kulin and Kurnai of central and eastern Victoria respectively. McBryde's investigations, however, have so far concentrated largely upon surface finds — that is, they have

yielded little time depth concerning the antiquity of the social structures identified. Dated axes from stratified contexts are rare in Victoria. This makes it difficult to be confident about the more distant past and may indeed imply that McBryde's interpretations are applicable only to ethnohistoric and recent prehistoric times. Alternatively, it is equally possible that the absence of older, dated axes from her sample implies a recent beginning for the systematic exchange of axes (that is, within the last few thousand years at the most). If so, major changes in socio-cultural practices, including their organisational principles, may be indicated.

McNiven (1990, 1991, 1992a) investigated patterns of change and stability in subsistence-settlement systems in the Cooloola region of southeastern Queensland. He documented increases in the use of local stone and faunal resources during the last c.900 years, which he interprets as implying the '*development of a more regionally focused exploitative system which was far less integrated with inland areas*' (McNiven, 1991: 22). McNiven's interpretations infer major structural changes in socio-cultural practices, including the development of relatively bounded social units during the late Holocene.

To the immediate south of Cooloola, a similar model of change has also been developed for the Moreton Bay region by Morwood (1987), and further elaborated by Hall & Hiscock (1988) and Walters (1987, 1989). Here, they present evidence for '*increases in the number of discrete socio-political groups*' during the late Holocene (Hall & Hiscock, 1988: 15). They argue that when sea levels changed, populations expanded and that, as a result, '*a gradual fissioning of groups*' occurred (Hall & Hiscock, 1988: 15). They further argued that if the social groups documented during ethnohistoric times existed during earlier times, '*we should have picked up some archaeological traces of them. That we have not provides compelling argument in favour not only of their movement into those areas during the Holocene, but also that a number [of] new groups formed during that period*' (Hall & Hiscock, 1988: 15). The evidence presented by the above authors for intensified use of regional landscapes relies largely on four factors:

1, significant increases in the numbers of large shell middens after c.1,000BP;

2, the appearance of bevelled pounders after around 1,500BP, where such artefacts are believed to have been used in the processing of plant tubers (see McNiven [1992b] for evidence

of their mid Holocene antiquity). Since such tubers probably acted as a staple food resource, their initial appearance during the late Holocene may indicate the beginnings of productive activities capable of supporting large populations;

3, the development of large cemeteries (e.g. Broadbeach) some 1,200 years ago, which may imply the beginnings of localised socio-political and territorial networks (see also Pardoe, 1988, 1993); and

4, the emergence of localised linguistic networks during the late Holocene: '*... the Gnugi people of Moreton Island have diverged linguistically from adjacent groups and may have begun such divergence perhaps as much as 1000 years ago*' (Hall and Hiscock, 1988: 15) (see McNiven, [1990, 1991] for an apt critique of Hall & Hiscock's interpretative framework).

Other research into the spatial properties of social networks have also been presented by Ross (1981), Smith (e.g. 1988), and Pardoe (1988). Of these, Pardoe (1988) specifically addresses the dynamics of territorial networks via the archaeological record. He argued that cemeteries developed along the River Murray Corridor perhaps 13,000 years ago, becoming '*well defined and numerous*' in the last 4,000 years, and that this did not take place in surrounding areas (Pardoe, 1988: 14). Because of the spatially-bounded nature of cemetery practices, he concluded that: '*... the social organisation of the River Murray people, perhaps as far back as 13kya, was clearly designed at least partly around some form of corporate descent group — an established group reckoning kinship and membership through common ancestry, and one which acted as an individual in social and political affairs. Whether these are lineages or clans is beyond this analysis, but ... we should probably view these groups as territorially based and their burial grounds as one of the symbols validating corporate ownership of that territory.*'

In contrast, whatever the land-based organisation of coastal groups to the south and east and of arid zone groups to the north and west, they did not use the cemetery as evidence of group affiliation and resource control. ... different forms of organisation may have precluded the establishment of the localised unilineal descent group and its symbol.' (Pardoe, 1988: 14-15).

Further research directly related to territorial behaviour has also been undertaken by Lewis (1988) for Arnhem Land. He argued that during the height of the last glaciation, an extensive interaction network existed throughout the

Bonaparte catchment, which extended from the Kimberleys to the Victoria River, Arnhem Land and beyond. Evidence for this comes in the widespread distribution of relatively small, dynamic figures known as Mimi in Arnhem Land, and Bradshaw in the Kimberleys, and in their occurrence in the Victoria River region between the two. During relatively recent times (the last 2,000 years or so), however, this type of rock art was replaced by a broad suite of regional styles, such as X-ray art in Arnhem Land, Wandjina paintings in the Kimberleys, and striped anthropomorphs in the Victoria River region. Lewis (1988) thus argued that the rock art of northern Australia became more regionalised during the last c.2,000 years, and that this was a result of climatic changes, including the development of wetlands, accompanied by widespread population increases (see David et al., 1990a for a discussion of this model; see also Taçon, 1993).

Finally, and perhaps most importantly, is Morwood's (1979) work in the Central Queensland Highlands. Morwood argued that during the late Pleistocene and early Holocene, stone tool and rock art assemblages were relatively homogeneous throughout much of mainland Australia. Around 4,300 years ago, however, a '*distinctive Central Queensland rock art type*' began to emerge, and this coincided with the appearance of the Small Tool Tradition (Morwood, 1979: 408). He concluded that '*changes in Central Queensland stone-working technology at this time can be seen as a regional manifestation of a Pan-Australian change*', with important implications '*for inter-group relationships within Australia*' (Morwood, 1979: 409). Such implications, he argued, may have included the development of increasingly regionalised social networks from relatively open social systems (Morwood, 1986).

Although other research projects have also asked questions relating to past Aboriginal spatial networks (Cosgrove et al., 1990; Lampert, 1980, 1981; Maynard, 1976, 1979; McBryde, 1974, 1976; Pearce, 1973, 1974; Poiner, 1976; Smith & Cundy, 1985), these have largely been eclectic in nature, synchronic in approach, and most have employed interpretative frameworks based on principles of ecological adaptation (Hall & Hiscock, 1988; Lewis, 1988; M.A. Smith, 1988, 1989; Veth, 1989). Enquiries have often focused on the appearance of new traits in a given area, and rarely have they treated internal social dynamics as capable of generating major changes in socio-cultural relations. Our understanding of

the dynamics of inter-regional networks through time is therefore poor, although the works of McBryde, McNiven, Morwood and Lewis all hint that socio-cultural relations may have changed significantly sometime, or at various times, during the late Holocene.

There is a precedent for treating spatial factors as highly relevant to temporal issues, but, to date, such concerns have not been widely explored in Australian prehistory.

THEORETICAL FRAMEWORK

As already noted, we view temporal trends in Australian prehistory not in terms of episodes or traditions, but as the product of Aboriginal political, economic and social dynamics. Our aims are to investigate patterns of stability and change in the spatial distribution of cultural conventions through time, taking Wobst's (1977) and Gamble's (1982) view that stylistic continuity implies the operation of information exchange networks across space (see below for a discussion of style). By continuity, we refer to the repeated presence of particular cultural conventions across space and/or through time. The presence of such networks has important implications for the operation of territorial networks and their dynamics through time.

Our approach has been strongly influenced by the works of Gamble (1982, 1983, 1986), Hodder (1978, 1986a, 1987), Conkey (1982, 1989, 1990) and Wobst (1977). We follow Gamble (1983: 202) in treating environment as setting '*limits to what is viable within the specifications set by the social system*' (see also Ingold, 1980). That is, environmental conditions are treated as contributing to socio-cultural change and stability, but not as the controlling or determining factor. For example, while risk-minimizing survival strategies are likely to emerge in risky environments, the potential range of behaviour is very large, and the choices that people make are guided in many ways by particular historical circumstances. In this sense, history is dominant; and although some forms of behaviour may be more likely to emerge than others as a result of environmental constraints, specific behavioural forms are not inevitable (Gamble, 1983). Furthermore, we will not interpret the ensuing archaeological patterns in adaptive terms (as Gamble [1982] and Yengoyan [1976], amongst others, have done), because of the '*post hoc accommodative nature*' of adaptive thinking (to paraphrase Conkey, 1990: 11). Rather, we must

ask how and why particular traits or sets of social strategies arose, and to do so we must enquire how they emerged from immediate historical circumstances.

SOCIAL SYSTEMS, SOCIAL STRUCTURES AND POWER

Following Marx (1947), Sartre once noted that people are at once '*both the product of ... [their] own product and historical agent[s] who can under no circumstances be taken as product[s] ... this contradiction must be grasped in the very movement of praxis ... [people] make their history on the basis of real, prior conditions ..., but it is ... [people] who make it and not the prior conditions. Otherwise ... [people] would be merely the vehicles of inhuman forces which through them would govern the social world.*' (1968: 87).

In this sense, socio-economic change involves dynamic processes relevant to all productive and reproductive modes, including fishing-hunting-gathering, agricultural and industrial societies, rendering their traditional differentiation largely meaningless (see also Layton et al., 1991). In this sense also, Australian Aboriginal socio-economic systems were not merely static networks deterministically linked to ecological strategies of foraging optimisation (as implied by Birdsell [1957], Yengoyan [1976] and others), but dynamic structures controlled, to a large extent, by internal social relations. As Shanks & Tilley (1987) note, social change concerns forces of stability, necessitating an investigation of the social forces by which systems are regulated (within and between all aspects of social life such as the traditionally distinguished economy, politics, ideology etc.). The questions asked of prehistoric Australian Aboriginal society are now directed at influences affecting changes in the structure of the systems examined, processes traditionally associated with more complex societies. For example, non-farming peoples are now seen to be capable of intensifying economically without necessarily venturing into new productive modes, thus removing the intensification process from a traditional hunter-gatherer to farmer frame of reference (Bender, 1979; Layton et al., 1991; Lourandos, 1983, 1991).

A basic assumption of our work is that life strategies, including modes of hunting and foraging, are not independent of social organisation and of the social system's internal dynamics. These include the means by which systems are reproduced, encompassing the particular symbolic sets and communicative networks of the

social systems studied. The concept of 'power' is important in understanding this relationship. By power, we mean two things. Firstly, because socio-cultural conventions help individuals locate social practice in a field of possibilities, they participate in the formulation of their world views. As such, conventions represent common symbolic structures which have power in the sense that they guide the actor onto a scene of possibilities. Ways of doing things not only reflect choices made within the framework of established socio-cultural systems, but actively partake in the development of individual behaviour. We may thus say that style is a source of power which encodes the range of immediate behavioural possibilities.

If ways of doing things vary through space and time, we may say that they are amenable to spatial analysis. Precisely because of this, material items also act as symbols of the times. By virtue of their creation within specific socio-cultural contexts, material items can thus be used to investigate spatio-temporal order in the social and cultural world.

Conventions are inherently hegemonic systems of communication, by definition amenable to duplication (self-reproduction). By definition also, they articulate a normative process enacted by people differentially distributed through space. As such, the spatio-temporal distribution of specific conventions is linked to the nature of social relations and territorial networks, and the presence of particular stylistic conventions facilitates information exchange by creating common symbolic structures through which information can be shared (Wobst, 1977). According to Franklin (1986), in some cases such conventions are explicit symbols of identity, as with flags, national anthems and the like. In the majority of cases, however, conventional behaviour is learned and practiced not as part of an overt attempt to create an identity, but because the range of learned behaviour is limited, and therefore patterned by those limitations. Because of this, social conventions have an intrinsic force that guide people towards a set of potential future actions.

Secondly, people also make behavioural decisions. Consequently, human praxis is closely intertwined with social mechanics, which include the way that social systems are organised and the politics of decision making. Change and stability involve decisions made within the context of established convention, social hierarchies and the interplay of various interest groups. They need

not be directed towards food production or towards any other commodity, let alone towards increasing productive efficiency. This issue also highlights the inadequacies of many previous models of change, such as those of Binford (1983), who argues that the change from hunting and gathering to agriculture in the Old World was geared towards the increasing of food production in the face of environmental stress: '*... if agriculture developed in some way out of the practices of non-agricultural people, then it seems reasonable to suppose that it arose to solve a problem that some of them were facing. What on earth could that problem be? Surely it was environmental, because the problems of food procurement for hunters and gatherers must be a by-product of the dynamics of the environment in interaction with man*' (Binford, 1983: 199).

Binford identified food and environment as the operative variables. Among other things (see following discussion), we would stress his '*some of them*', which focuses on the social asymmetry of the immediate historical circumstances. Economic endeavours and decision-making only exist within the context of wider power relations. Given that a social system's structure helps to define the distribution of power, it thus follows that structural changes in a social system may affect its economic framework by altering the power relations (Hodder, 1986a; 1986b; Ingold, 1980, 1991). For this reason, and in the spirit of Thomas (1981: 171) and others (e.g. Ingold, 1980), treating socio-cultural change as an epiphenomenon of economic change fails to consider the internal dynamics of strategies employed. For example, Ingold (1980) has argued that the dynamics of reindeer herding, and other subsistence practices, among the Saami can only be understood by consideration of social practice, which involves sharing and accumulation, and production for subsistence purposes and the market. All of these are essentially linked to the way social systems are organised — to the dynamics of their social relations. These factors are not, however, independent of a region's ecology. As Ingold (1980: 7) notes: '*... the properties of a cultural system, including its technological component, are not autonomous, but are derived from a combination of underlying social and ecological conditions*'.

As such, we should not but expect complex spatio-temporal patterns, for change involves interacting individuals and groups, each of which employ a broad range of practices through the course of their lives. Hence a change in settlement

strategies does not necessarily mean that an old strategy will be abandoned. Nor does it mean that a new strategy will be expressed in all archaeological contexts. Rather, any given archaeological context may only contain the remains of a narrow sub-set of the full behavioural range. Some of these new behavioural modes may not register in the archaeological record as significant departures from previous strategies. This does not necessarily mean that systemic changes have not taken place, but may simply imply that our sampling procedures have not given due attention to this issue. This is a problem inherent to sampling in archaeology as a whole, for when compared to the life-spans of individuals, the discipline is inherently concerned with relatively broad-scaled temporalities. The temporal trends that will be observed in the following pages should thus be interpreted within this context; that is, they should be treated as general models of change and stability, rather than as fine-grained temporalities.

New strategies articulate with established conventions. Through time, any of these may be differentially modified. Because of the dynamic nature of social life, fields of experience are continuously established, becoming (emerging) from immediate historical precedents. To better understand this process, we must enquire into social structure and the politics of social and economic organisation, for it is here that power relations are perhaps best represented. It is by investigating these relations that important information on the forces which have directed change through the course of prehistory may be revealed.

STYLE AND CONTEXT IN SOCIAL SYSTEMS

Like Hodder (1986a, 1986b), we view archaeology as a step towards the construction of prehistories, as essentially searching for patterns in the material record. Such patterns are viewed as being constituted meaningfully, in the sense that they are not random but a function of structured behaviour. People behave in socially and culturally circumscribed ways, but because such conventions are not so much rigid formats of behaviour as fields of familiarity, their material outcomes may be difficult to characterise.

As Smith (1992a: 29) notes: '*... in theory, artists can depict anything they wish, but they don't*'. This is an important starting point for this work. Following Sackett (1977: 370), it is assumed that '*form is an index to history*', in that behaviour is encoded by socio-cultural conven-

tion. The range of possible ways people can behave with respect to any aspect of life is inconceivably large, restricted only by immediate historical choices made impossible or unlikely by historical conditions (viz the Law of Negation of Negation [cf. Bochenski, 1963; Sartre, 1968]). Hence Sackett (1977: 370) writes that: '*... the material culture of any given society exploits only a few narrowly selected ranges of the enormously broad spectrum of formal possibilities that are potentially open to it. In short, there are invariably alternate means of achieving the same end and a society tends to 'choose' but one of them; and since the potential range of equally valid and feasible options is so great, chance alone dictates that the precise choice made in one society is extremely unlikely to be made in another, unrelated society*'.

We begin by treating rock art as being influenced by socio-cultural convention, which means that by analysing the distributions of rock art conventions through time and space, we are investigating continuities and discontinuities in material behaviour. Where conventions are relatively homogeneously patterned across space, it is assumed that a continuity exists in social practice; the presence of contiguous traits implies some form of interaction between individuals or groups across space. In contrast, dissimilar traits are treated as signifying some form of discontinuity in material behaviour. The latter specifically indicates that people behaved differently with respect to that particular material item, but not necessarily with respect to other things. This implies a discontinuity in a specified field, or context, of action. For example, differences in the way people dress means that there is a discontinuity in contexts of dress, but not necessarily of any other factor, such as language, eating habits, hair-styles and so forth (or even in other contexts of dress). We are not talking about 'peoples' in a culture-historical sense, but about specific practices. Documented cases of continuity and discontinuity in the distribution of rock art conventions have implications for the spread of conventions across space and through time, which in turn is directly related to contexts of information exchange and inter-regional behaviour.

The conventions used in creating and using material items are often referred to in terms of style (S. Binford, 1968; Conkey, 1978, 1989, 1990; Davis, 1990; Sackett, 1977, 1982; Wiessner, 1983; Wobst, 1977). However, style is a broad term which refers to combinations of

particular conventions (e.g. patterns of line, colour, design elements and so forth), such as in McCarthy's (1968: 125) definition of style as '... *the total design or pattern of a figure*'. Such concepts are analytically combersome, and do not encourage investigations of definable spatial/temporal continuities and change. Because of this, our own analysis will focus more on the distributions of specific conventions, rather than on broad styles.

There have been many definitions of style offered in the literature during the past thirty years especially, and we will not attempt to review these here as they are, in the main, of little relevance to this work. Furthermore, we do not view the various definitions as conflicting, for they largely address different aspects of the concept, such as those that concentrate on the role of style in effecting communication and interaction in harsh environments (Gamble, 1982), its active participation in creating and reproducing social formats of behaviour (Hodder, 1981, 1986a) and its role in information exchange, social communication and negotiation (Wobst, 1977). An important set of assumptions (generally common to the above definitions of style) will nevertheless be made here. These assumptions include:

- 1, social interaction is patterned, in the sense that for any context of interaction, social sets are involved. Such sets can take a very large number of potential formats, such as age sets, friendships, clans, sports clubs and so forth;

- 2, following (1), behaviour becomes contextualised;

- 3, social interaction, and human actions in general, involve material properties. Because of the patterned nature of behaviour, matter also becomes patterned; and

- 4, any given social practice involves an interaction of a very large number of contexts. Partly because of this, the social correlates of material patterns are usually ambiguous.

Because of the above issues, Conkey (1990: 15) has argued that the distributions of styles should not be treated as representing the distributions of social groups or cultures, but implies '*that what style can tell us about is not culture or groups per se, but the contexts in which group or other social/cultural phenomena are mobilized as process*' (see also Conkey, 1989: 119; Hodder, 1978, 1981, 1987). Such contexts are archaeologically ambiguous. They can, for example, relate to clan affiliation, language groups or tribal membership, all of which consist of formal and exclusive sets of social actors. An

example of such contexts occurs amongst the *Dhuwa* and *Yirritja* moieties of eastern Arnhem Land (Morphy, 1977, 1991). Here, individuals of a given moiety share common rights in various social practices, such as ritual roles, dances and painting designs (see also Keen, 1977). As Smith, quoting Morphy (1977: 182) notes: '... *clans belonging to the Yirritja moiety all own variants of a basic diamond pattern [in bark paintings], while those of the Dhuwa moiety own various design combinations of a square and a set of opposed curved lines ... these designs simultaneously serve to differentiate groups in terms of their rights to particular tracts of country.*' (Smith, 1992a: 33).

Such formal, structural contexts of social interaction, however, do not constitute the full array of patterned social behaviours. Our ultimate concerns are not so much with formal structures per se, but with the way in which praxis has been structured in the process of social interaction. This is what we mean by the 'structure' of social behaviour. These issues cross-cut formal structural concerns, while, at the same time, including them. By this we mean that while formal social structures are involved in the creation of patterned social behaviour, other factors also come into play. It is, in part, because of this that we refer to the archaeological record as ambiguous when it comes to its social contextual correlates. An example of this issue is presented by Thomson, who notes that among Aboriginal groups in Cape York Peninsula, '... *where the territory occupied by a tribe was extensive, the clans at one side of the tribal territory frequently had more in common with the clans of neighbouring tribes than with those of their own tribe situated on the other side of the territory.*' (Thomson, 1972: 1).

This point is extremely important for the concerns of this work, as it highlights the fact that patterned behaviour cannot be treated solely in terms of formal groups (e.g. clans, tribes, languages), but also needs to consider less formal relationships. Proximity of individuals and groups may thus relate to spatial dimensions or to a potentially infinite number of social or cultural relations. For instance, it may involve friendships, which may be more appropriately treated in terms of inter-personal interaction than in terms of formal social sets such as age-mates or clans. The significance of this is that such interactions can cross-cut formal social boundaries, and therefore need not reflect them.

As with Conkey (1978, 1989, 1990), Gamble (1982, 1986) and others (e.g. Hodder, 1986a), we



FIG. 1. *Menngen* (white cockatoos) from the Victoria River region, Northern Territory.

will be concerned with investigating patterned behaviour through space and time, and not about formal social structures or formal groups such as clans, tribes and the like. It is praxis (human action) that is at stake, and not groups as such. By investigating the distribution of material forms (e.g. rock art conventions, stone artefact types and technologies), we are enquiring into behavioural conventions operating within varied socio-cultural contexts. By investigating continuities and discontinuities in the spatio-temporal distribution of these conventions, we are also addressing change and continuity in those contexts.

ON FORM AND MEANING

It is important to note here that our approach is, in the first instance, an archaeological one. In investigating the distribution of artistic conventions through time and space, we follow Maynard (e.g. 1976) in comparing and contrasting specific traits of the material record. As such, an important

component of our work is pattern recognition. Our analysis does not involve any assumptions concerning the original meanings of the rock art held by its creators, nor by its subsequent users. In this, we differ radically from Layton (1992), who has recently argued that the analysis of prehistoric Australian rock art can be undertaken within an anthropological framework that involves attributing meaning to the art. Our reasons for not following such an approach involve three major components:

- 1, meanings change through time (Frost et al., 1992);

- 2, meanings change through the context of interaction (David & Flood, 1991; Flood et al., 1992); and

- 3, designs can be multivocal or multivalent (Munn, 1973). That is, their meanings may be ambiguous in that they can have multiple meanings at the same time or under different contexts. Although Munn (1973) argued such a case for non-figurative Warlpiri art, a similar situation for Wardaman figurative art has recently been documented (David & Flood, 1991; Flood et al., 1992; Frost et al., 1992; Merlan, 1989a; see also Arndt, 1962).

Because of these issues, our reference to the formal attributes of rock images are purely labels of form, identified from our own perspective. For instance, reference to 'dog' paintings merely implies that, by virtue of specific design traits, the image looks to us like a dog. We do not claim to know why the image of a dog may have been painted on a wall. It is possible that the artist indeed meant to represent a dog in painting, but it is equally possible that the image of a dog was a metaphor for something else. It is hence highly possible that a painting with formal resemblances to a dog, for instance, was in fact a depiction of an object which is to us totally unrelated. An example of this involves the Wardaman of the Northern Territory, who commonly use anthropomorphic images to depict the identities of the Dreaming beings belonging to a particular landscape. For instance, in what is identified as peewee (magpie-lark) country (*gulirida*), Dreaming figures identified as peewees by the Wardaman are depicted in painting as anthropomorphs. Similarly, white cockatoo (*menngen*), hawk (*gornbu*) and other Dreaming beings are also depicted in human shape (Fig. 1) (David et al., 1990b). This issue has been discussed more extensively elsewhere (David & Flood, 1991; Frost et al., 1992; see also Merlan, 1989a). In this sense, a particular form may not merely be a metaphor

for something else, but may be multivocal. That is, it may have multiple meanings at the same time or under changing contexts of interpretation (cf. Munn, 1970). This issue may also highlight the ambiguity of conceptional systems to outside observers, for the relationship between humans and other things (such as, for example, white cockatoos) may be different in the Dreaming and in Western ontologies. Therefore, it is not only the material representations of things (e.g. in paintings) that may be prone to metaphorical manipulation, but the meaning system itself may be ambiguous if viewed through a different ontological framework. In this sense, a search for original meanings would necessitate a recovery of the artist's metaphysical reality, since to understand the original meaning(s) of a particular painting would necessitate situating that depiction in the artist's world-view, itself constituted and constituting a whole world of symbols, sets and representations. In short, the present study is not concerned with emic meanings, nor with emic systems of classification, but with the system of forms which people have used in making marks on cave walls in the course of north Queensland's prehistoric past.

For this reason, Clegg (1978) has suggested that an exclamation mark (!) be used to precede formal terms such as dog (e.g. !dog). We have not followed this convention, however, as it is felt that it is sufficient for us to state the nature of our approach. Although we follow Hodder (e.g. 1986a) in assuming that the archaeological record is meaningfully constituted, as Conkey (1990: 11) notes, *'to view rock art conventions as meaning-bearing does not mean that they are necessarily messaging. Rather, it is implied that social conventions, such as rock art 'styles', have only the potential to be received as messages'*. It is this potential which, as discussed above, gives material items their power to participate in social production, reproduction and negotiation.

SOUTHEAST CAPE YORK PENINSULA

Cape York is Australia's largest peninsula, jutting north of latitude 17°30'S and forming the northeastern extremity of the mainland. Throughout this work, the terms 'Cape York Peninsula', 'Cape York', 'north Queensland' and 'the Peninsula' will be used interchangeably herein, as is common practice. This is not withstanding the fact that 'Cape York' is also the

proper name for the protruding tip of the Peninsula. To the north, it is separated from Papua New Guinea by Torres Strait, which forms a cultural and natural corridor between the two major land masses (Walker, 1972). The Peninsula is environmentally diverse, containing a broad range of landforms such as low-lying sand plains, plateaux, rainforests, mangroves and dissected gorges. It is a region rich in biodiversity and varied in geomorphology.

The Peninsula has been defined in various ways by different authors. The most widely employed definition is that of Stanton & Morgan (1977), who characterised the region as a biogeographic zone containing relatively bounded geological and faunal systems within *'forest communities, with the southern boundary defined by the southern limits of stringybark (Eucalyptus tetrodonta) forest. Most of Cape York Peninsula receives greater than 1000mm rainfall per annum and is subject to a strong and regular seasonal influence'* (Stanton & Morgan, 1977: 2). However, we have not followed this definition here, as it excludes much of the southern parts of the peninsula proper (as defined geographically).

The region chosen for the current study is the southeastern corner of Cape York Peninsula (Fig. 2). For the purposes of this study, it is defined as the area bounded to the north and south by latitudes 14°00'S and 17°30'S, and to the west and east by longitudes 143°00'E and 146°00'E respectively. Like the Peninsula in general, it is a diverse landscape. To the east it includes the coastal zone and its offshore islands, and to the west it bisects the Peninsula longitudinally. The reasons for defining the study region in this way are largely heuristic, as it includes a large number of closely-spaced research projects, from Princess Charlotte Bay and the Flinders Island group in the north, to Ootana in the south (see below). As such a concentration of relatively detailed archaeological data is contained within — and covers most of — the study region. This near-continuous data base links-up with Morwood's (1990b, 1992; Morwood & Godwin, n.d.) work in the Upper Flinders River catchment to the immediate south, and with the Central Queensland Highlands further to the south again (Morwood, 1979). Combining the various data sets available from southeast Cape York Peninsula affords us a window into the prehistoric past of one well-defined section of Australia, and enables a detailed investigation of diachronic trends for the region's prehistory.

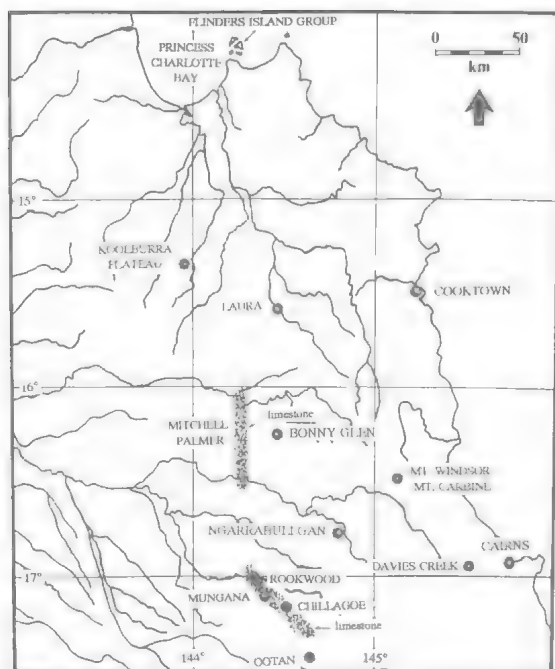


FIG. 2. The study region in northern Queensland.

The southeast Cape York natural land systems are in many ways a microcosm of the broader peninsula. Their comparability stems largely from their similar division into a number of sub-parallel longitudinal geomorphic and biogeographic belts. The low relief of the western landscape merges eastwards with the gentle western slopes of the Great Dividing Range. The latter is not so much a continuous range as an aggregation of hills, tablelands, gorges and low-lying areas, forming the watershed between the Gulf of Carpentaria to the west and the Coral Sea to the east. These uplands consist principally of Cainozoic basalt flows and pyroclasts often referred to as the Atherton Tablelands. Immediately north and west of Cooktown, a synclinal depression known as the Laura Basin extends to Princess Charlotte Bay, and is flanked by massive quartzose and glauconitic sandstone, siltstone and conglomerate outcrops of the Battle Camp Formation. This is the location of the famed Laura sandstones. To the immediate north, localised volcanics, such as those occurring along Cape Melville and in the Coen Inlier, occur mainly in dispersed patches as an extension of the Great Dividing Range. To the east, the Great Divide falls steeply in elevation, flanking narrow coastal plains (Cainozoic alluvium) (Common-

wealth Department of National Development and the Queensland Department of Industrial Development, 1971). Vegetation communities vary considerably with geological and topographic conditions; mangroves and rain-forests dominate along the coast and on the eastern and upper slopes of the Great Divide, changing rapidly to dry sclerophyll woodlands to the west.

Within this generalised east-west trend exist localised and specialised landforms. One such land system is the limestone belt located along the western slopes of the Great Dividing Range, towards the southern end of the Peninsula. The limestone belt is surrounded by endemic, deciduous vegetation known as microphyll vine thickets (Fig. 3).

As with geomorphology and biogeography, Cape York Peninsula exhibits a range of climatic regimes. The interaction of two major pressure systems dominates the present climate in northern Queensland. The sub-tropical high pressure belt, made up of anti-cyclonic cells, and from which the southeast trade winds emanate, is an important influence during the dry season (May–October). During the wet season (November–April) this is replaced by the Inter-Tropical Convergence Zone (ITCZ), which in emerging from oceanic air masses picks up moisture that is precipitated over the Great Divide through orographic uplift. These summer monsoons, with their moist, unstable maritime conditions and high oceanic temperatures, are conducive to the development of regular precipitation. Such conditions are also favourable to the development of tropical cyclones, which are erratic but dramatic rain-bearing events producing high quantities of precipitation in rapid bursts. Rainfall throughout the region is therefore highly seasonal, with heavy rains during the wet season and low rainfall during the rest of the year. These rains are relatively predictable annual occurrences, although their precise timing can vary. Mean maximum temperatures of up to 35°C are associated with the wet season months, while during the dry season they are some 10°C lower. Both the west and east flowing streams have high discharge during the wet season, but many are reduced to intermittent waterholes or completely dry-up during the dry season.

PALAEOENVIRONMENTS

Palaeoenvironmental reconstructions for southeast Cape York Peninsula rely, to a large

degree, on research undertaken in other parts of northern Australia. Eight such sources of information are available.

SIMULATION STUDIES

In 1972, Nix & Kalma published their simulation study on north Queensland's palaeoenvironments. Their study was based on postulated changes in air temperature, precipitation and vapour pressures associated with established glacio-eustatic trends. Their model covers the last 22,000 years (Table 1).

The implications of Nix & Kalma's simulation work are that arid conditions can be expected from around 22,000 years ago to the end of the Pleistocene. Surface water during that time would not have been as common as today, resulting in a slight shift northwards and eastwards of arid-adapted taxa. Much of the study region was probably covered by low open woodland during this time, and there may have been a lower diversity of taxa than at present.

During the early Holocene, arid-adapted taxa retreated south and inland, and *'the rivers in northern Australia would have a more sustained dry season flow and gallery forests ... would be well developed'* (Nix & Kalma, 1972: 87). Woodland became dominant, although open and even closed forests developed in many localities.

The last 3,000 years witnessed a slight reduction in the availability of surface water (that is, an effective drying) and a return of some open forest communities, although woodland continues to be dominant.

SEA LEVELS

A number of studies have been undertaken on changes in sea levels in north and central Queensland (Hopley, 1983; Chappell et al., 1983; cf. David, 1987: 31-32; see also Woodroffe et al., 1988). Six major trends, covering the last 11,000 years, have been identified:

- 1, by around 11,000BP, the Gulf of Carpentaria was flooded by marine transgressions;
- 2, much of the eastern continental shelf was exposed before c.8,500BP;
- 3, the Torres Strait land bridge was severed by around 8,000BP;
- 4, the eastern continental shelf was flooded to present levels between 7,000 and 5,000BP;
- 5, sea levels were gradually falling during the latter parts of the Holocene, although there was a very slight emergence between 6,000 and 3,000BP; and

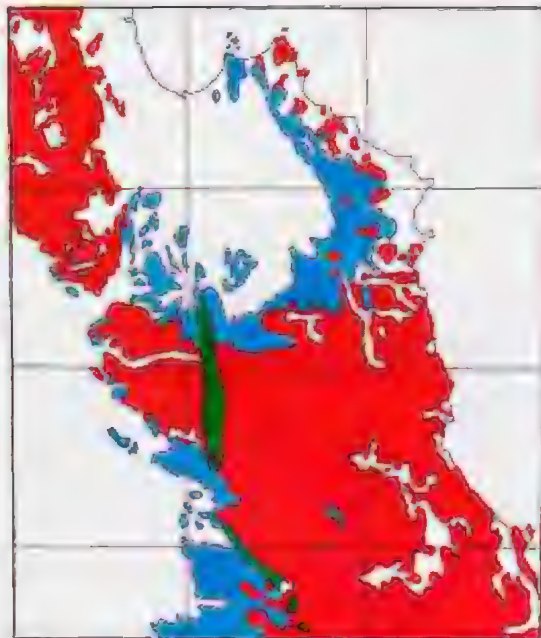


FIG. 3. Southeast Cape York Peninsula, geology (after Day et al., 1983). Red = volcanics & metamorphics; green = limestone; blue = sandstone.

6, much of the eastern continental shelf experienced reef growth and the formation of micro-atolls by around 5,000 to 4,000BP.

Cooler ocean currents during the last glacial maximum (c.22,000-17,000BP) led to decreased atmospheric moisture, decreased convection, drier winds and, consequently, decreased levels of precipitation. Levels of atmospheric humidity and precipitation increased with the initial flooding of the Gulf of Carpentaria c.11,000BP, but it was not until c.8,000BP that warm ocean currents flowed across Torres Strait, amplifying existing climatic trends.

Much of the eastern Australian continental shelf was exposed before c.8,000BP, protecting modern-day coastal regions from high energy storm activities. A rapid submergence of the land after that time created a *'high-energy window'* (Neumann, 1972, quoted in Hopley, 1983), subjecting the newly-flooded continental shelf to increasing convection and other oceanic storm processes. Micro-atoll and outer reef formation after 5,000-3,000BP once again protected the east coast from high energy events, closing the high energy window to give us the present climatic regime. The period of relatively high sea levels, from c.6,000 to 3,000BP, can be expected to have

been relatively wet, as convection would have been most active at that time.

OXYGEN ISOTOPES

^{18}O isotopes are of greater mass than ^{16}O isotopes. Therefore, the former are more abundant in water during periods of low sea levels, as ^{16}O atoms are preferentially evaporated. By investigating the proportions of ^{16}O and ^{18}O atoms preserved in the uplifted coral reefs of the Huon Peninsula (Papua New Guinea), Aharon (1983) was able to identify a number of important changes in late Quaternary temperatures. In particular, he argued that: '*... relatively rapid fluctuations in the average annual temperatures are recorded between 53 to 37KA, with a maximum cooling of -6°C below present during a marine regression of 43KA. However, surface ocean temperature was only 2.6°C below present prior to the last glacial maximum, during the brief marine transgression at 28.5KA.*' (Aharon, 1983: 4).

CHENIERS

Cheniers are coastal ridge formations that form through the accumulation of shell-bed and coastal sediments during high-energy storm events. The episodic character of chenier-building events is due to an interplay of sea level changes, coastal and nearshore changes in sediment budgets, and degree and intensity of storm activity. Chappell (1982) and Chappell et al. (1983) investigated the history of chenier formation at Princess Charlotte Bay and on a series of islands in north Queensland. They noted that at Princess Charlotte Bay '*... ridge building has occurred at rather a constant rate over the last 2000 years. There are 12 or 13 ridges in the interval 1000 to 2000 years BP and 11 or 12 ridges in the interval 0 to 1000 years BP. Figures for the period prior to 2000 years BP are not comparable, as progradation rates were much slower.*' (Chappell et al., 1983: 232).

After close examination of the numbers of storm ridges formed in each 500 year interval at Princess Charlotte Bay and other parts of north Queensland, they concluded that: '*There is no indication that ridge building was exceptionally high or low in any 500-year interval. This set of data does not suggest any significant temporal variation of storminess There is yet no evidence for changes in storminess in the last 4000 years and perhaps the last 6000 years There is no evidence to hand that might indicate climatic change in the same period.*' (Chappell et al., 1983: 233).

LAKE LEVELS

Geomorphological investigations at Lake Woods (Northern Territory) and Lake Gregory (northern Western Australia) indicate that the lakes were larger than present before c.26,000BP (Bowler, 1983). Bowler (1983) argued that the sizes of the lakes indicate that effective precipitation at that time was some five times as great as today's. Greater rainfall during the lake full stage indicates a humid expansion around 28,000-26,000BP, and this is probably best explained by increases in summer rainfall at that time. The lakes then began to contract before 25,000 years ago. The development of longitudinal dunes on the exposed floor of Lake Gregory is evident after c.25,000BP, indicating the advent of arid conditions. Environmental conditions at this time were more arid than they are today.

POLLEN ANALYSES

Most of the pollen records published from northern Australia come from Kershaw's (1970, 1971, 1974, 1975a, 1975b, 1993) studies near the Atherton Tablelands and on the edge of the continental shelf immediately to the east. His work at Lake Euramoo, Quincan Crater, Bromfield Swamp, Lynch's Crater and Strenekoff's Crater and the ODP site 820 has revealed a series of pollen sequences spanning the last 190,000 years. Environmental conditions during the last 60,000 years on the Atherton Tablelands are summarised in Table 2.

It is to be noted, however, that the Atherton Tablelands are climatically a very sensitive region. They are situated only 25km to the west of the coastline, and therefore directly affected by orographic processes. The area is exposed to oceanic winds, and it may be particularly responsive to minor changes in temperatures and precipitation due to its high elevation. Consequently, while the pattern of change observed for the area may be more broadly applicable, their intensities may not be. Indeed, recent palynological investigations in the Laura region indicate that environmental change may not have been as great as on the Atherton Tablelands (Stephens, 1990; Stephens & Head, 1992).

OTHER

Palaeoenvironmental data have been obtained from two other sources. Galloway et al. (1970) noted that dunefields at Cape Flannery were formed during the early Holocene or slightly earlier. They concluded that their southeast orien-

tation suggested an essential continuity in predominant wind directions since that time.

The second source concerns the sediment history of Colless Creek rockshelter (Hiscock, 1984a, 1984b, 1985; Hughes, 1983). Two major stratigraphic units were recognised within the deposits, one spanning the last 18,000 years (Unit A), and the other (Unit B) dating to earlier times. Hughes (1983) concluded from his analysis of the sediments that the period before 18,000BP witnessed wetter conditions than today, while the last 18,000 years were considerably drier than before. This chronological framework is coarse-grained, and does not address fluctuating rainfall patterns during each period of time.

PALAEOENVIRONMENTS: SUMMARY

In spite of minor differences in timing, there appears to have been a number of consistent trends in the nature of climatic change across northern Australia. The greatest uncertainty occurs for the period before 22,000BP, whereas palaeoclimatic reconstructions for the last 10,000 years are the most secure. In synthesising the various sources of palaeoclimatic information, we have identified six major climatic periods for the last 40,000 years of north Queensland prehistory:

40,000-38,000BP. This was a relatively wet phase, although both absolute and relative rainfall levels were probably lower than they are today;

38,000-25,000BP. Temperatures were low, but increased slightly from c.36,000 to 30,000BP, then decreased to their lowest value sometime after 25,000BP. Rainfall levels were decreasing throughout this period in north Queensland, whereas in northern Western Australia and the Northern Territory low precipitation was restricted to the period after 25,000BP. This may

have been due to the differential effects of the eastern and northern continental shelves on the two regions;

25,000-17,000BP. This is the last glacial maximum, and is characterised by decreases in sea levels, temperatures, and effective precipitation;

17,000-8500BP. Effective and absolute precipitation was low. This was probably caused by a combination of cooler temperatures (decreased evaporation), exposed continental shelves (drier air masses), decreased oceanic temperatures (decreased convection), and a severance of warm oceanic currents from northern Australia (decreased convection). After the height of the glacial maximum, around 17,000BP, these conditions were slowly reversed. By c.8,500BP, both effective and absolute precipitation had increased to levels higher than today's; temperatures were probably similar to today's;

8,500-3,000BP. This was a period of high rainfall and high temperatures. This was partly due to an opening-up of the northern and eastern continental shelves, the creation of an eastern high-energy window, the presence of convection as a result of warm ocean currents, increased air and oceanic temperatures and higher sea levels. Around 6,000 to 5,000 years ago, sea levels were similar to today's (and possibly slightly higher), and micro-atoll and reef formations began to appear. The latter closed the high-energy window, slightly decreasing rainfall, and thus effective precipitation also;

3,000BP-present. Following a lowering of absolute and effective levels of precipitation around 3,000 years ago, northern Australia attained its present climatic regime. There is no evidence for major climatic changes since that time.

THE EXCAVATIONS

INVESTIGATING TEMPORAL TRENDS IN SOUTHEAST CAPE YORK PENINSULA

In this section we will investigate temporal archaeological trends (patterns of change and stability) in southeast Cape York Peninsula. In doing so, we will ask a number of questions of each site and subregion investigated:

1, What is the nature and timing of typological change in the stone artefact industries excavated

from each site, subregion and the region as a whole?

2, Are there changes in the numbers of sites used in any given subregion through time?

3, Are there changes in deposition rates of cultural materials and sediments from each site through time? and

4, What is the antiquity of the rock art present in the excavated sites?

Question 4 will be addressed in the next section (The Rock Art), along with a discussion of spatial trends in the region's rock art.

In addressing these questions, we will focus on three general issues:

1, Are the various changes documented through time at each site and subregion contemporaneous (e.g. changes in stone tool types and in general cultural deposition rates)?

2, Are there spatio-temporal patterns to these changes?

3, Are these changes directional? By directional, we wish to infer neither pre-determination nor causation (as Bird & Frankel [1991] accused Lourandos [1983] of attempting). Rather, directional changes are those that take place along a definable trajectory during a specified period of time. Hypothetical examples of such changes may be a continued increase in the mean length of working edges relative to stone artefact weights, or the decreasing use of a particular type of raw material through time.

METHODOLOGY

In asking the above questions, two separate data sets have been used:

1, results from excavations undertaken by one of us (BD) specifically for the purposes of this research; and

2, results from excavations undertaken independently of this work (mainly by other researchers).

In ordering this large database, we present site reports in two major groups, beginning with our own excavations, and followed by those of others. Taken together, these studies have enabled an examination of temporal trends at site, subregional and regional scales for north Queensland. A glossary of terms used is presented in Appendix A.

QUESTION 1: THE NATURE AND TIMING OF TYPOLOGICAL CHANGES IN STONE ARTEFACTS

An investigation of typological changes in the stone artefacts of individual sites is geared towards an investigation of change and stability in the way stone use and manufacture have been influenced by social and cultural conventions. The antiquity of stone artefact types is investigated by identifying their first appearance within individual sites. Individual sequences are then compared and contrasted at subregional and regional scales to determine whether or not spatio-temporal trends are present. In doing so, we stress that archaeological chronologies, by their relative coarseness, may not be sufficiently fine grained to allow the documentation of differences in the timing of new traits between neighbouring subregions.

QUESTION 2: CHANGES IN THE NUMBERS OF SITES USED THROUGH TIME

In asking whether or not there have been changes in the numbers of sites used through time, we have documented the number of dated sites occupied within the region at any point in time. The number of sites occupied through time addresses issues dealing with either changes in the intensity of use of a region, or in the way the landscape was utilised. The latter need not be related to overall population increases or decreases (contra the approach taken by Beaton [1985, 1990]). In either case, a change in land use is implied. Note, however, that previous authors have investigated this issue in a variety of ways. For example, Bird & Frankel (1991) used the total number of reported radiocarbon dates from excavated sites to determine changes in the intensity of occupation of the Victorian southwest, whereas Flood et al. (1987) analysed the numbers of sites occupied at different points in time to address similar issues for the Southern Australian Uplands.

QUESTION 3: DEPOSITION RATES OF CULTURAL MATERIALS AND SEDIMENTS

In order to address issues relating to site use, we have attempted to estimate the deposition rates of cultural materials and sediments within individual sites. In order to do this, we have often used depth-age curves to estimate the antiquity of individual analytical units, such as spits or layers. In doing so, however, it is important to note that such estimated ages should not be treated as 'true' dates, but as hypothetical ages that may be useful in investigating gross temporal trends. They have been interpolated from depth-age curves, following the method outlined by Hughes & Djohadze (1980). They should not be taken literally as reflecting synchronic values but, rather, as useful in an investigation of diachronic trends. Because of this, interpolated ages will be differentiated from radiocarbon dates throughout this work by placing the former in italics (e.g. *1,000BP*). None of the radiocarbon determinations presented here are calibrated dates (because many go beyond the limits of calibration).

Why Depth-Age Curves are Used: Converting the Raw Data into Temporal Data. There have been numerous research projects undertaken in southeast Cape York Peninsula during the last 15 years. These have taken place in diverse landscapes and by numerous researchers. Consequently, much of the previously published data, as well as the results of our own excavations, have had to be standardised so as to be able to compare

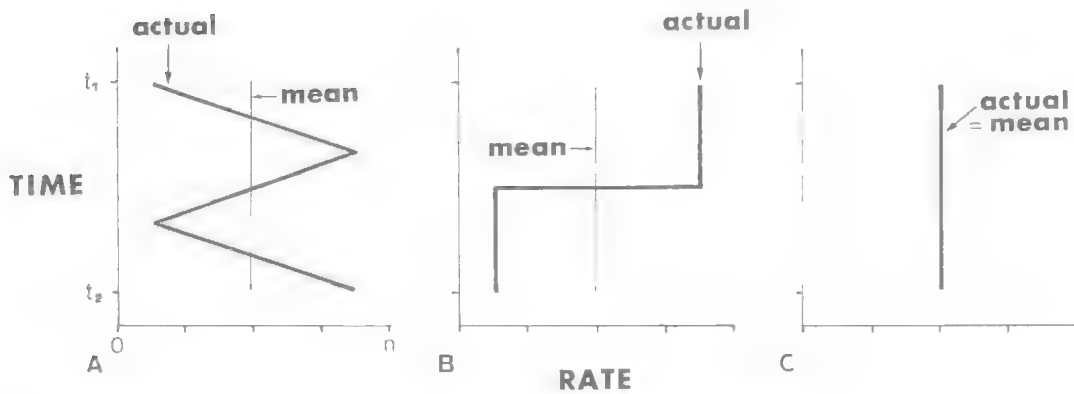


FIG. 4. A critical step in the calculation of interpolated ages is that sedimentation rates between two radiocarbon dates have been averaged-out. Diagrams A-C demonstrate three possible scenarios that may give rise to a mean sedimentation rate between two radiocarbon dates. A, significantly fluctuating rates are averaged-out; B, periods of low and high sedimentation rates are separated by one or more depositional hiatuses; C, regular deposition rates realistically reflect mean rates.

and contrast the various site and subregional databases.

Most of the site reports available include a number of radiocarbon dates and tables documenting the numbers and/or weights of cultural materials excavated in each spit and/or layer. In some cases (e.g. Flood & Horsfall, 1986), the original site reports claimed to have identified particular trends in the deposition rates of cultural materials, by reference to the amounts of cultural materials recovered from various spits or layers. Spits and layers, however, do not necessarily cover equal spans of time. Consequently, such comparisons may not have been justified. Because of this, in the following chapters we have attempted to re-analyse many of the trends presented previously by individual authors for sites in southeast Cape York Peninsula. This was done by converting the raw data from individual spits or layers into deposition rates (that is, amounts of material deposited per unit of time).

Depth-Age Curves. Depth-age curves were first used in Australia by Hughes & Djohadze (1980) and Hughes & Lampert (1982) in order to investigate sedimentation and cultural deposition rates in caves and rockshelters. They argued that 'by using depth-age curves, units covering a given time-span can be defined that allow rates of accumulation of the components of the deposit, for example sediment, stone artefacts and shell, to be calculated' (Hughes & Djohadze, 1980: 20). These estimates were only attempted after a thorough examination of the sediments and stratigraphy of the site. As Hughes & Djohadze (1980: 20) fur-

ther noted: '... where ... a stratigraphic change is thought not to represent a hiatus in deposition its age can be estimated with confidence by interpolation from a depth-age curve, provided the dates are relatively closely spaced in depth'. When radiocarbon dates are widely spread in age or depth, the estimated (interpolated) ages of particular levels between two radiocarbon dates are less reliable. This is particularly the case when detailed geomorphological investigations have not been undertaken.

Calculating Deposition Rates. Maximum and minimum age estimates can be calculated for any analytical unit (e.g. a spit) from a depth-age curve, although the greater the age between two radiocarbon dates, the greater the potential for the estimated ages to be in error. The reason for this is that the joining of each radiocarbon date to construct a curve implies an averaging of depositional and erosional rates over the entire duration of time between two radiocarbon dates, thereby masking potential hiatuses, lag deposits and the like (Fig. 4). To lessen this problem, other available geomorphic evidence, such as sediment hiatuses and lag deposits, should be taken into account when using depth-age curves. Because of this, depth-age curves constructed between two radiocarbon dates spanning a considerable period of time may be of limited reliability. This point is critical to our analysis, as it means that in some cases (e.g. the Holocene levels at Fern Cave), the deposition rates calculated should only be treated as gross estimates, perhaps subject to considerable error. For this reason, the resulting patterns

should be treated as models of change requiring further investigation. Unfortunately, this problem cannot be resolved with the evidence available, and will thus have to await further work in the region. We will come back to this point at various times throughout this work.

Once the age of each spit has been estimated, it is then possible to calculate deposition rates for various cultural materials from each unit. We have done this using the following procedure:

1, data from each unit analysed (usually a spit) were converted to a standard unit of horizontal space. This standardisation involves converting all quantifications to m^2 . For example, raw data excavated from a $0.25m^2$ ($50cm \times 50cm$) square are multiplied by four (e.g. if four stone artefacts are excavated from a $50cm \times 50cm$ square, its artefact density would be $16/m^2$). It is only once this is done that the raw data can be compared, for the comparisons will then be based on a common spatial denominator;

2, depth-age curves were then used to convert all quantifications to equal units of time. Once the time span covered by a given unit (a spit or layer) is estimated, it is possible to convert the raw data from that unit into quantities of material deposited over any given unit of time. These are usually calculated per 100 years. The resultant quantifications enable us to compare deposition rates per m^2 per 100 years for each spit or layer within a given sequence. For example, if 16 artefacts/ m^2 were recovered from a spit estimated to cover some 200 years, a deposition rate of 8 artefacts/100 years can be calculated. Note, however, that these deposition rates have been converted from the raw data. Deposition rates should not, therefore, be treated as primary data, but as estimates based on the assumptions and limitations inherent in the construction of depth-age curves. Because of this, our previous caution concerning the reliability of age estimates interpolated for each analytical unit also applies to the acceptance of deposition rates. This problem will only be resolved when large numbers of radiocarbon (or other absolute) dates are obtained for each site, thus enabling us to investigate relatively fine-grained changes in depositional regimes with a greater degree of confidence.

DISCUSSION OF DEPOSITION RATES

If we assume that the excavated samples are representative of the site as a whole, changes in deposition rates would imply either that a), people were doing more (increases) or less

(decreases) of the same within a site, without population sizes changing; b), populations increased or decreased and, as a result, deposited different amounts of cultural materials to previously; or c), changes in methods of artefact production and/or use resulted in changes in the amounts of materials deposited on the ground (see below). In each case, a change in social practice is implied, assuming that post-depositional taphonomic factors have been taken into account. To allow for this assumption, wherever the data are available, taphonomic factors, including the effects of dingoes, the re-working of sediments and so forth, should be taken into account.

Having said this, it is important to note that a number of authors have questioned the use of artefact deposition rates in investigating temporal trends from the archaeological record. Many archaeologists (e.g. Flood et al., 1987; McNiven et al., 1992; Morwood, 1981) employ such rates as indicators of the relative intensities of site use through time. But from here there is considerable methodological variation. Hence Hiscock & Hall (1988) used total artefact deposition rates at Bushranger's Cave (southeastern Queensland) to address such issues. Hughes & Lampert (1982), on the other hand, employed the deposition rates of retouched flakes ('implements') to investigate relative intensities of site use at Burrill Lake, Currarong and Sassafras. Hughes & Lampert nevertheless saw a problem, in that changes in the deposition rates of both implements and other stone artefacts may simply reflect changes in the numbers of stone artefacts used per head of population, rather than changes in occupational intensities at any given site.

Hiscock (1981) criticised Hughes & Lampert's (1982) use of stone implement, rather than total artefact, discard rates to indicate gross changes in the relative intensities of occupation within archaeological sites. He argued that:

1, changes in implement discard rates will also be affected by changes in site function;

2, the numbers of waste flakes will reflect changes in site use as much as the numbers of implements will;

3, if we wish to measure intensity of site use through artefact numbers we must situate the lithic component within a broader economic framework, as shown in other aspects of the archaeological record (e.g. bone remains and settlement patterns). Hence we must firstly understand site use and the role the lithic component played in the occupation of sites;

4, changes in artefact densities may primarily reflect changes in raw material use; and

5, we must understand more about depositional behaviour, that is, the relationship between artefact manufacture, use and deposition, before stone artefact numbers can be used as indicators of relative occupational intensities.

These comments are critical to the use of any single criterion in measuring intensities of site use (and by implication its relationship to population sizes), and similar concerns were more recently forwarded by Ross (1985), who argued that discard rates may be affected by such things as:

- 1, discard behaviour;
- 2, degrees of curation and recycling of stone implements;
- 3, duration of occupation;
- 4, technological changes; and
- 5, changes in raw materials.

In this context, it is important to note that the types of quantifications attempted by Hughes & Lampert (1982) do not attempt to distinguish between duration and frequency of site use in addressing relative occupational intensities. Rather, such measures simply attempt to model relative occupational intensities over broad time spans. This is also the approach adopted here, although we use total artefact counts to construct our discard rates.

MULTIPLE VARIABLES

Because of the nature of our major research questions, a detailed analysis of the stone artefacts from the excavated sites was not attempted by us (recognised stone artefact types are extremely few in north Queensland assemblages). It is thus concluded that, given the possible multivariate influences on artefact discard rates, investigations of temporal trends in the relative intensity of use of any given site should consider more than one variable (see also Lourandos 1983). For example, Barker (1989) has found that at Nara Inlet 1 (Whitsunday Islands), stone artefact deposition rates decreased significantly after around 3,000 years ago. This decrease was associated with a contemporaneous increase in bone and shell artefact deposition rates, indicating that a shift in technologies may have taken place. At the same time, deposition rates of food residues increased dramatically. In this case, an analysis of any single variable would probably have masked the overall pattern of change, which involved technological replacements as well as increases in deposition rates of food remains. It was only by taking into account a suite of vari-

ables that an appropriate characterisation of temporal trends could be made.

We have followed a similar approach to that of Barker and others (e.g. Hiscock, 1989) in the present work, in that, where the data exist, we have relied on multiple variables in order to investigate temporal trends. In addition to deposition rates of cultural materials, general sedimentation rates have also been considered.

SEDIMENTS

Hughes (1977) and Hughes & Lampert (1982) have argued that sedimentation rates may be useful when investigating changes in the intensity of occupation of caves and rockshelters, as the former tend to increase along with intensities of human occupation within a site or area. This can take place in a number of ways, the principle being:

- 1, through the introduction of new materials into a site (e.g. wood, charcoal, stone artefacts, bone etc.);
- 2, via the initiation of cave wall disintegration as a result of human-induced microclimatic changes (e.g. heat-induced exfoliation from hearths); and
- 3, by the initiation of slope instability and colluvial slope wash as a result of firing of the landscape.

Because of this, Hughes & Lampert (1982) concluded that sedimentation rates may be a potentially valuable avenue by which to investigate occupational intensities. Coupled with investigations of the deposition rates of cultural materials, such rates may offer a means by which observed trends can be independently tested.

ORGANIC REMAINS

In the site reports discussed in the following pages, we have focused on variables which can give reliable information on temporal trends. For most sites, these include deposition rates of stone artefacts and sediments. Because of problems of preservation, deposition rates of organic remains such as bone, charcoal and the like are not focused upon, although such rates are presented wherever the data are available. Nevertheless, it is important to note that in many sites — in particular the limestone rockshelters — there is no evidence for increasing mechanical or chemical weathering (i.e. decay) of the organic component with depth. On the contrary, in many of the sites excavated, the lowermost (pre-occupation) deposits contain organic materials which do not appear to have been deposited by humans

(e.g. owl deposits). In many cases, detailed taphonomic investigations are necessary to enable a fuller appreciation of organic deposits, but unfortunately such investigations were not completed at the time of writing. Nevertheless, the presence of natural bone deposits, such as those accumulated by owls and numerous small rodents and lizards deep in the sequences, suggests that the absence of anthropogenic bone in these levels is not a result of the decay of faunal remains. Rather, in such cases, it appears that anthropogenic bone was just not there in the first place. Furthermore, there is also a general correlation between amounts of bone and other cultural variables, such as stone artefacts and charcoal, in most sites. This suggests that the low amounts of organic materials in the lower units may largely reflect their lower deposition rates.

In short, few of the excavated sites show any evidence for preferential disintegration of organic cultural materials, such as bone and charcoal, in the lowermost deposits (unlike many Australian coastal sites; but see the Koolburra Plateau and Laura sites). This is especially so of the limestone sites, such as Fern Cave and Mitchell River Cave, but it is also the case for Ngarrabullgan Cave, a sandstone site. Nevertheless, we have relied mostly on other variables, such as deposition rates of stone artefacts and sediments, in an attempt to eliminate the role of differential preservation in our investigations of temporal trends. This is important, as it might otherwise be argued that the observed cultural changes should instead be interpreted as a function of changing taphonomic conditions.

DISCUSSION

Each of the variables discussed above relates to specific aspects of social life. For example, stone artefact deposition rates relate to systems of stone reduction (including modification/curation), use and deposition. Charcoal, on the other hand, largely relates to firing practices, while ochre is associated with artistic activity. Each variable addresses a specific range of social practices within a given socio-cultural system. Hence, although each variable may be linked by virtue of its participation in a particular socio-cultural framework, no single variable can offer unambiguous evidence of any specific social process, such as population increase or a change in the nature of site use. As noted above, we will therefore be considering multiple variables in the analyses presented below. Our aims are to ad-

dress broad changes in socio-cultural practices. To do this, we will concentrate on identifying changes in items relating to various aspects of social life, such as stone artefacts and animal food remains. In doing so, the individual variables will be treated separately, and the trends revealed for each variable will then be compared and contrasted to determine patterns of change and stability within individual sites and sub-regions. Each piece of evidence presented will thus be treated as a component of a multivariate set.

SCALES OF RESEARCH

Because of the regional and inter-regional concerns of this research, our own fieldwork was not based on the detailed analysis of a single excavation. Rather, as many sites as possible were tested during the time available. Consequently, each excavation was small, and many of these should be treated as test pits rather than full-scale excavations. This approach was deemed preferable to the large-scale excavation of a single site (or few sites).

PREVIOUS RESEARCH

Archaeological research in southeast Cape York Peninsula began in the mid 1960s, when Wright (1971) excavated a number of rockshelters near Laura, Mareeba and Chillagoe. In the mid 1970s, Rosenfeld (1975; Rosenfeld et al., 1981) excavated the Early Man site near Laura, but it was not until the early 1980s, when Campbell (1982, 1984) initiated long-term investigations in the Chillagoe region, that systematic research began in earnest. The history of research for each part of the study region will be discussed below in their appropriate subregional contexts, but it is worth noting here that most of the excavations have been undertaken in rockshelters. Because of the wide range of techniques used by different researchers in excavating, analysing and presenting their excavation data, we have given as much information as possible on the techniques used. In some cases, these techniques significantly limit the types of interpretations that can be made of the data. This is well exemplified by Frankland's (1990) comment that 3mm sieves may not be appropriate for the recovery of fish bones, which are likely to pass through the mesh.

THE MITCHELL-PALMER LIMESTONE BELT

The Mitchell-Palmer limestone belt is located some 180km northwest of Cairns, towards the centre of the study region. The limestone juts out above the surrounding plains as rugged peaks (towers), some of which measure up to 3km in length, 1km in width, and reach up to more than 150m in height (Chillagoe Caving Club Inc. 1988). Their surrounding pediments are often covered with microphyll vine thickets, more commonly known as dry rainforest. Although only 5km in width, the limestone belt extends south for 60km, disappearing below the ground immediately south of the Mitchell River (Figs 5, 6). It's re-appearance 20km further to the south (near the Walsh River) is discussed below.

The Mitchell-Palmer limestone belt forms a localised and highly specialised biogeographic zone. Caves are abundant throughout the limestone, two of which were excavated by one of us (BD) in 1989 (Hearth Cave and Mitchell River Cave), and a further site, Mordor Cave, in 1991 (David, 1991c; David & Dagg, 1993). In all cases, the excavation methods followed those of

Johnson (1979). These methods included: maximum 10 litre bucket spits within stratigraphic units, with all cultural materials over 2cm maximum dimension recorded in three dimensions, plotted on a master map, and bagged separately. All other materials were sieved through 3mm wire-mesh sieves and subsequently sorted in the laboratory. Sediment samples were collected from each spit of each excavated square.

The aims of the three Mitchell-Palmer excavations were to link the known archaeological sequences from Princess Charlotte Bay, the Koolburra Plateau and Laura to the north, with those of Chillagoe to the south. The northern sites had been previously excavated by other researchers (mainly during the 1970s and early 1980s), revealing broad cultural trends. The three sites from the Mitchell-Palmer limestone belt were excavated for two main reasons:

- 1, to obtain temporal data on the antiquity of rock paintings and engravings from the area. The Mitchell-Palmer subregion contains a homogeneous body of rock art, and the art found in each of the three sites excavated was typical of the area. Excavations were, therefore, located beneath localised decorated panels in order to

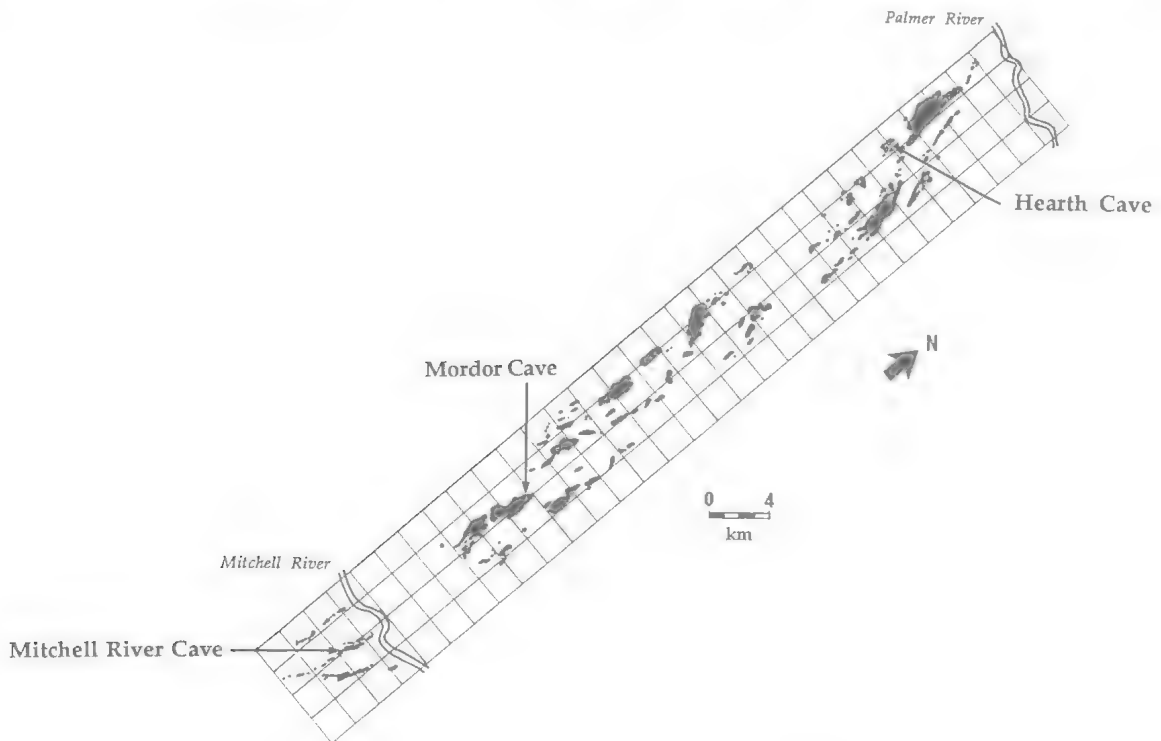


FIG. 5. The Mitchell-Palmer limestone belt, showing locations of excavated sites.



FIG. 6. Limestone karst tower, Mitchell-Palmer limestone belt.

retrieve stratified fragments of ochre, and hence to date the paintings by stratigraphic association.

2, from surface observation, the three sites chosen were considered to have the greatest potential for deep sequences of any of the sites visited in the region. In each case the slope of the adjacent cave wall, and the horizontal spread of surface deposits, suggested that the deposits were likely to be deep. Because of the questions posed in our research, it was important to excavate sites with significant time-depth in order to investigate temporal changes. Shallow sites — which greatly outnumber deeply stratified sites in the region — were thought likely to contain relatively recent deposits only, and were therefore not considered suitable for the present research. The following observations are thus skewed towards the preferential excavation of sites which were considered as possibly containing old deposits.

HEARTH CAVE

Hearth Cave is located towards the northern end of the Mitchell-Palmer limestone belt, immediately south of the Palmer River (Figs 5, 7). It was recently rediscovered during speleological explorations by the Chillagoe Caving Club, who reported: 'Located on 01/04/83 by M. Andersen on north eastern end of tower ... A phreatic slot leading back into tower, 3m wide at entrance. Floor is moss and fern covered. Slot develops to the rear far enough to provide shelter from rainfall. In the small narrow section at the back is a significant ash pile, 2m by 2m and 200mm to 300mm higher than the rest of the floor. Eroded sections of this floor shows evidence of broken bones, a possible kitchen midden.'

The walls have a number of Aboriginal paintings, some superimposed on each other on the left hand wall. Observed were a boomerang in white and other paintings vertical scrapings with small numbers at lesser angles. They have been apparently made by someone standing, as they are in easy reach at waist level to hand outstretched in height. Exposure is 2m long by 1m high. Right hand side has scrapings, 12 or so scratches but nothing of real significance. Cave is an archaeological site.' (1988: 62).

Hearth Cave was specifically chosen for excavation because of the presence of patinated peckings at the site. Non-figurative peckings similar to those found at Hearth Cave are relatively rare in the Mitchell-Palmer region, and were believed to have considerable antiquity at the Early Man site near Laura (Rosenfeld et al., 1981) (see below). Consequently, a deep stratigraphic sequence was anticipated at Hearth Cave.

EXCAVATION AND STRATIGRAPHY

Four juxtaposed 50cm x 50cm test pits were excavated, two of which were located against the cave wall in order to determine whether or not rock art continued below the shelter floor. The latter was found not to be the case. However, to date only one square, Test Pit 3, has been fully analysed and reported (David & Dagg, 1993). Consequently the following does not deal with data excavated from the other three squares. Preliminary analysis of the excavated material from the other three squares appears to be consistent with the temporal trends observed from Test Pit 3.

Test Pit 3 revealed five stratigraphic units (SU) (David & Dagg, 1993). SU5, the lowermost layer, is not clearly distinguishable from SU4 above it, and was only identified from the sections, after



FIG. 7. Hearth Cave.

the excavation was completed. Four radiocarbon dates were obtained, two of which came from Test Pit 3, the other two from Test Pit 2. The oldest date is $21,500 \pm 250$ BP (Wk-1719), indicating that occupation dates from the late Pleistocene onwards. The radiocarbon dates are listed in Table 3 (see David & Dagg, 1993).

Stone artefacts are present from pre-21,000BP times, and continue to the uppermost levels at Hearth Cave. The radiocarbon dates of $4,100 \pm 120$ BP (Beta-54024) and $3,494 \pm 84$ BP (R 14023 NZA 1383) both come from SU4b, suggesting that SU4b may date from c.21,000BP to c.3,500BP. However, a sedimentary history of the site needs to be constructed in order to further address this issue. Oriented sediment thin sections and other sediment samples have been collected with this aim in mind. In particular, we need to determine whether or not sediment hiatuses occur at the site. This may be particularly important for a proper understanding of occupational trends at Hearth Cave, especially during SU5 and SU4b times. Such investigations will have to await a fuller site report (forthcoming).

The $3,494 \pm 84$ BP date comes from immediately below the top of SU4b, implying an ending date for SU4b. SU2 above it ends at approximately $2,360 \pm 70$ BP (Wk-1716).

CULTURAL MATERIALS: DEPOSITION RATES

It is not possible to determine deposition rates for the earliest times represented by the Hearth Cave excavations, as radiocarbon dates are not available for the basal units. By assuming a minimum of 21,500 years of occupation, however, *maximum* deposition rates can be calculated for the earliest occupational deposits, and temporal trends can then be explored. In doing so, it is stressed that the deposition rates calculated for the period before $4,100 \pm 120$ BP should be treated with caution. This is because no radiocarbon dates are available between this time and $21,500 \pm 250$ BP. No absolute dates can be used to determine the reliability of the interpolated ages calculated from the depth-age curve. This caution is doubly warranted given that detailed geomorphological investigations have not yet been undertaken for Hearth Cave.

Given the uneven nature of the stratigraphic units located near the southern end of the square, especially where SU2 dips down to form a depression, the calculation of deposition rates was only attempted for those parts of the pit where strata are laid approximately horizontally. Fig. 8 presents the depth-age curve from which the interpolated ages were calculated for each excavation unit (XU) and stratigraphic unit at

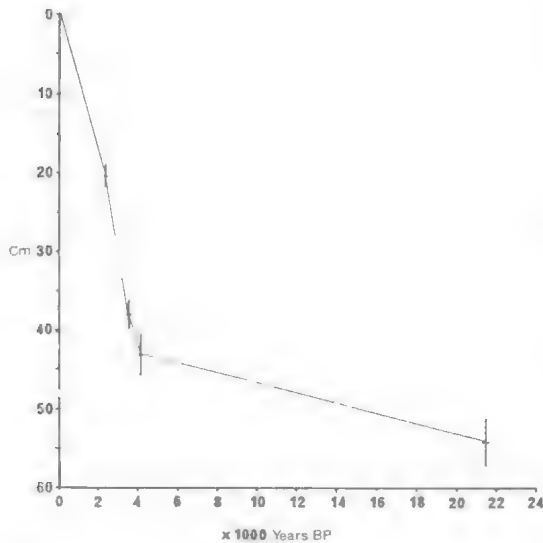


FIG. 8. Hearth Cave, depth-age curve. Y axis = cm below ground surface.

Hearth Cave. The interpolated ages of each XU are presented in Table 4. Table 5 presents the raw data excavated from Test Pit 3, while Table 6 and Fig. 9 transform these data to deposition rates for each XU. In Table 7, a similar procedure is attempted for each SU.

Although occupation at Hearth Cave began sometime before $21,500 \pm 250$ BP, sedimentation rates peak between approximately 3,500BP and 2,500BP, after which they again decrease. Deposition rates of all cultural materials show a similar pattern, being low until approximately 3,500BP, and subsequently increasing until 2,500-2,000BP, after which they decreased slightly and remained relatively stable from then on.

The Hearth Cave bone has not yet been fully identified, but it is notable that very large quantities of brush turkey egg shell occur in all cultural layers. Brush turkeys (*Alectura lathami*) lay their eggs from the end of the dry to the beginning of the wet season (August - December), offering a reliable seasonal marker for occupation at the site (W. Longmore, Queensland Museum, pers. comm., 1992). Although this question needs further attention, it is possible that the repeated large quantity of egg shell at Hearth Cave implies continuity of a seasonal settlement system, in the sense that rockshelters from the region are repeatedly occupied at least during the wet season. It is thus possible that such a subsistence-settlement system has considerable antiquity at Hearth Cave, although further research into this

issue will have to await systematic investigation of the faunal material, as well as investigations of other sites (including both rockshelters and open sites).

The temporal distribution of stratified earth pigments is similar to the distribution of other types of cultural items. Numbers of ochre fragments peak during the last 3,500 years, and high levels are maintained until ethnohistoric times. The very low deposition rates of ochre before approximately 3,500BP may signify that the cave paintings currently visible at the site postdate this time, although the excavations have furnished no direct indication of the age(s) of the underlying — and therefore older — peckings.

The increases in deposition rates documented from Hearth Cave after 3,500BP include the following:

- 1, increased sedimentation rates, which, following Hughes (1977) and Hughes & Lampert (1982), may be related to increases in occupational intensities;
- 2, increases in the deposition rates of bone, charcoal and burnt earth, which together may imply increased rates of hearth establishment and firing activity, and increases in the amounts of food consumed and discarded; and
- 3, increases in ochre deposition rates, which suggests an increase in painting activity.

Nevertheless, it is difficult to determine further the exact characteristics of the temporal frameworks involved. This is due to an absence of fine stratigraphy at the site, making it difficult to obtain discrete temporal units which can then be used to construct a chronological framework. However, the availability of three dates from $2,360 \pm 70$ to $4,100 \pm 120$ BP has enabled a fairly good assessment of changes around this time, although the temporal trends pre-dating $4,100 \pm 120$ BP have been poorly explored because of their poor chronological resolution.

STONE ARTEFACTS

The stone artefacts from Hearth Cave are largely amorphous, although technologically they may possess highly diagnostic characteristics (this remains to be investigated). Only two formal stone artefact types were identified from the excavation: a fragment of edge-ground axe from XU5 (1,100-1,450BP), and a burren adze slug from XU4 (700-1,100BP). Given their low numbers, however, it is difficult to make any generalisation about typological changes in the stone tool assemblage from the site. It may nevertheless be significant to note that the burren adze found at

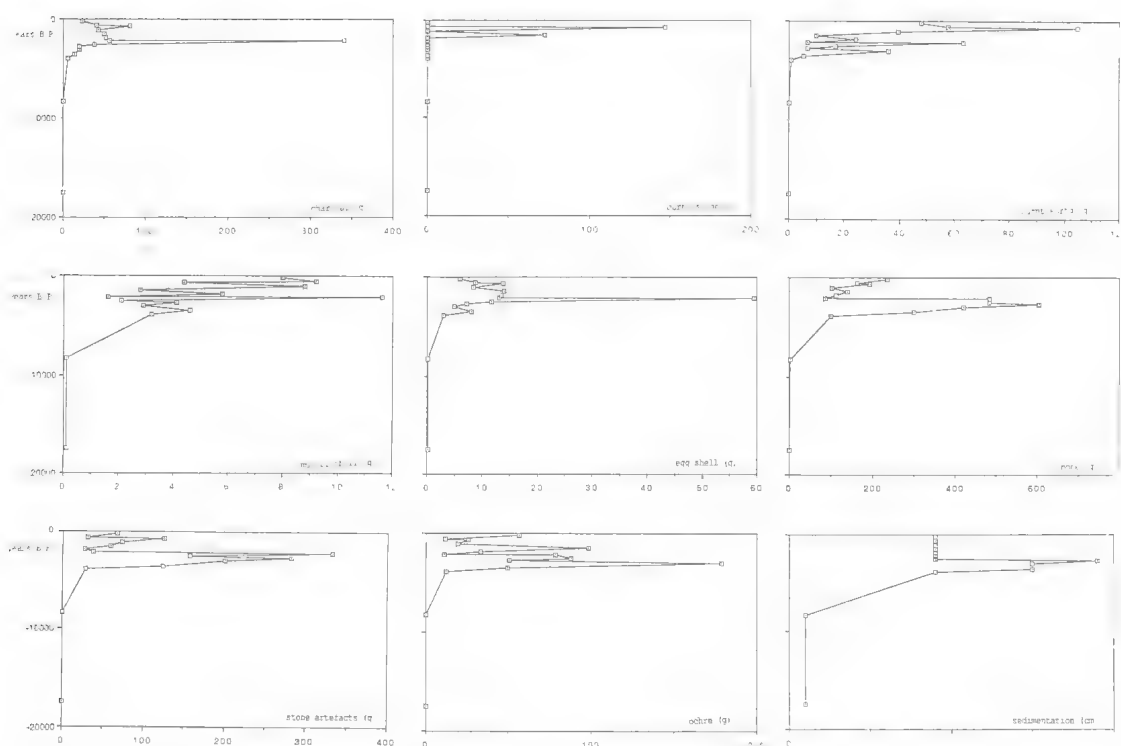


FIG. 9. Hearsh Cave: deposition rates, by XU.

Hearsh Cave was contemporaneous with those found at other sites in north Queensland (see below).

MORDOR CAVE

Mordor Cave is a large limestone cave with an uneven, rocky floor, located 26km south of Hearsh Cave (Figs 5, 10). It was rediscovered by L. Pearson on the 17th June 1979, when the Chillagoe Caving Club undertook speleological explorations in the Mitchell-Palmer limestone belt. Mordor Cave was described by the Chillagoe Caving Club Inc. as having '... three large entrances interconnected with twilight and dark zones linking them horizontally. A peripheral system with some excellent decoration. Aboriginal paintings are executed on walls in mono and bichrome silhouettes. There are over 140 individual paintings of human figures, dingoes, emus, bats and crocodiles. A pool of water would serve for ochre preparation. Some hand stencils and some inverted figures.' (1988: 43).

The main entrance to the cave involves a moderate climb up boulder-strewn pediments,

followed by a descent onto a flat floor located near the back wall. It is here that the only occurrence of soft, ashy deposits is found. A number of roof collapses give entry to deep caverns along both ends of the cave. Two edge-ground axes and a stone flake were found amongst collapsed material which can be reached by a short walk through pitch-black corridors in these caverns. It is possible that the artefacts were thrown into the collapsed chambers from the skylit chamber above (the main chamber containing the soft ashy deposits).

Mordor Cave was excavated mainly because of the large numbers of paintings and stencils on the cave wall, immediately adjacent to soft archaeological deposits. On the cave wall are 300 paintings and 11 stencils, most of which are monochrome infilled and red in colour. The great numbers of paintings located within a spatially constricted area near soft deposits were deemed to offer great potential for the recovery of stratified ochres, offering the possibility for dating the art by investigating temporal trends in ochre deposition. Two test excavations were undertaken in the soft ashy deposits. Square E18

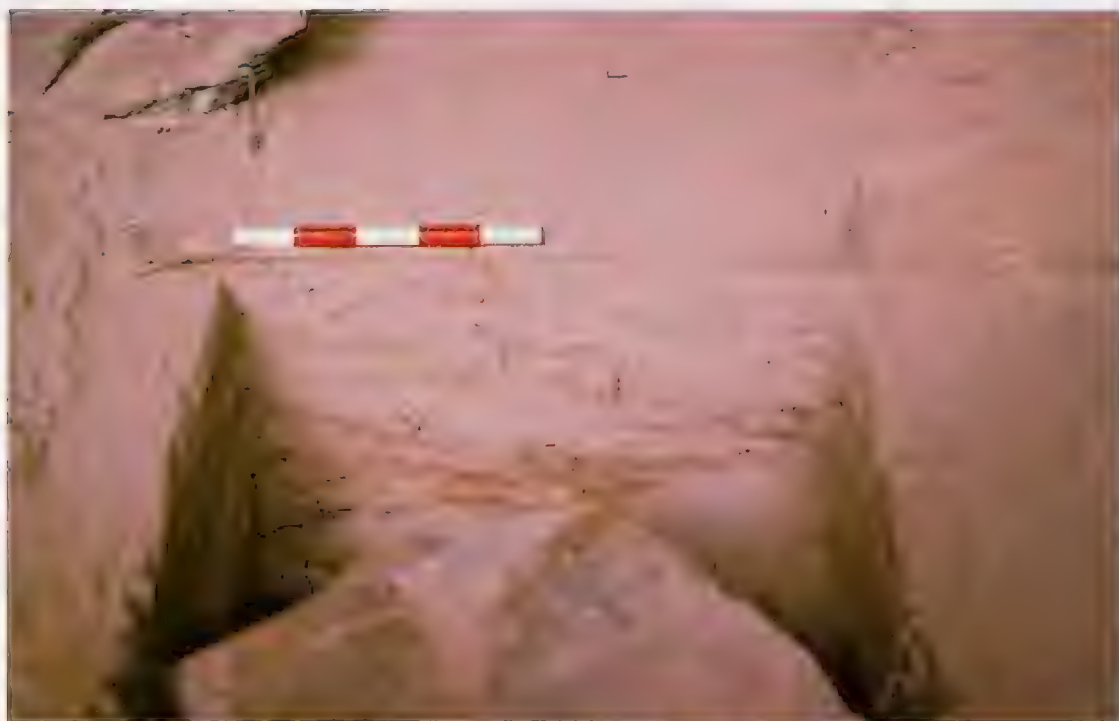


FIG. 10. Mordor Cave, excavation in progress.

consists of a single 50cm x 50cm pit located near the centre of the soft deposits, where sediments appear to be at their deepest in this part of the site. The main excavation was undertaken 3.5m from Square E18, and consists of Squares G10, H10, H11 and I10. Square H10 was initially chosen for excavation because it was located in what appeared to be the deepest part of the site. Squares E18, G10 and H10 were excavated to bedrock, while Squares H11 and I10 were only partly excavated in order to enable access into adjacent Squares G10 and H10. In total, 1.25m², or 2.0% of the 66m² of soft ashy floor, were excavated. All excavated sediments were very dry at the time of excavation. At some distance from the ashy deposits, closer to the dripline, large lag deposits indicate the existence of drip points and small seasonal pools of water.

The excavated materials from Squares E18 and H10 have been sorted and analysed and are presented here, but the analysis of materials obtained from the other squares has not yet been completed (see also David & Dagg, 1993).

SQUARE E18

Square E18 is well stratified, containing three major stratigraphic units. Cultural materials are

found in all stratigraphic units. SU3 is further sub-divided into two sub-layers. All stratigraphic units are well defined, their boundaries being marked. Excavation proceeded in seven excavation units, the average thickness of which was 2.6cm.

Square E18 is 20.0cm deep. A single charcoal sample was submitted for dating from XU7, immediately above bedrock. A radiocarbon date of $1,640 \pm 70$ BP (Beta-46,090) was obtained, with a $\delta^{13}\text{C}$ value of -28.4‰ . The $\delta^{13}\text{C}$ -adjusted age of 1580 ± 70 BP is taken to date the beginnings of occupation in this part of the site.

Because only a single date was obtained from Square E18, the time frames covered by each spit and SU could not be calculated. Therefore, quantifications have been calculated as amounts of materials deposited per m² per centimetre of deposit (Table 8; see David & Dagg, 1993 for raw data). Similar calculations were undertaken for Square H10 (see below). This standardisation was necessary because some XUs covered small areas only, as large boulders intruded into the excavation squares.

Interpretation of Sediments. The part of Mordor Cave represented by Square E18 is interpreted as having been first occupied

approximately 1,500 years ago. At that time, rates of occupational deposition were low. During SU3a times, large amounts of vegetation, including bark and twigs, were laid horizontally on the cave floor. This layer is well defined, and associated with low deposition rates of all cultural materials, except for stone artefacts and bone. The stone artefacts are very small, averaging 0.7g in weight. These factors indicate that the sediments recovered from SU3a may have been associated with a sleeping mat, and that during this time the area may have been used as a sleeping area. If this is the case, it is possible that contemporaneous materials from other parts of the cave would reveal complementary, specialised activity zones, such as hearths and stone artefact manufacturing areas.

During SU2 times, Square E18 witnessed relatively intense deposition of cultural materials. It is during this time that most of the paintings on the walls possibly were undertaken, as indicated by peak ochre deposition rates. Fires lit during SU2 times may have caused the high proportions of burnt egg shell in XU6 and XU7 underneath. As eggs cannot be roasted on a fire (or they would shatter or explode [Prof. L. Hughes, University of Queensland, pers. comm., 1992]), burnt fragments of egg shell are likely to represent subsequent burning by overlying hearths.

Stratigraphic unit 2 contains one large bracket fungus. It is a single sporocarp of a member of the Order Aphyllopharales, Family Polyporaceae. It is probably from the genus *Polyporus*, and possibly *P. udus* (P. Bostock & C. Young, Queensland Herbarium, pers. comm., 1992). The dryness of the cave, and the compaction of the sediments, indicate that it could not have grown in the deposits, but must have been introduced into the cave (Dr L. Hall, University of Queensland, pers. comm., 1992). Such fungi are known to have been eaten by Aborigines in north Queensland during ethnographic times.

SU1 times include the post-contact period, and the recent period when the site was abandoned. Consequently, the low densities of cultural materials during this time are not surprising.

SQUARE H10

Square H10 is 114.5cm deep, containing four distinct stratigraphic units, some of which are further sub-divided into a number of sub-units. Two radiocarbon dates were obtained:

980±60BP (Beta-46317), located 84.7cm below the ground surface, in XU25 (SU4). The

δ¹³C value equals -27.6‰, and the ¹³C-adjusted age is 940±60BP.

850±50BP (Beta-46318), located 114.0cm below the ground surface in XU28 (SU4). The δ¹³C value equals -28.2‰, and the ¹³C-adjusted age is 800±50BP.

The two radiocarbon dates are similar and overlap at two standard deviations. They are therefore taken to confirm the impression gained during excavation, that SU4 is an archaeologically instantaneous event.

Square H10 was excavated in 28 spits, XU10 of which was excavated in three sections (XUs 10a, b & c). Table 9 presents the quantities of materials calculated per m² per centimetre of deposit.

Cultural materials occur in all excavation units. Large amounts of vegetation were obtained from SU4, some of which are partly burnt (see David & Dagg, 1993). Given that relatively high percentages of burnt egg shell, as well as consistently high amounts of charcoal and burnt earth also appear in this part of the excavation, SU4 and SU4h may be related to a hearth. SU4 and SU4h may therefore represent materials dumped when a cooking hearth was emptied to retrieve the cooked food. However, while this explanation would explain the 'instantaneous' appearance of the deposits and the burnt material, it does not account for many of the cultural remains found within SU4/4h.

A number of wooden objects, including a digging stick from XU22 (Figs 11, 12) and a large sheet of cut bark containing a number of pandanus nuts around and on top of it (XU25), were also located within SU4/4h. A grinding stone with two ground surfaces was recovered from XU26. All of the ochre (3 white pieces, totalling 1.4g), none of which contained use-striations or faceted surfaces, came from XU25 and XU27. A fig (*Ficus virens* var *sublanceolata*, *F. obliqua*, *F. platypoda*, *F. racemosa*, *F. opposita* or *F. coronulata* [P. Bostock, Queensland Herbarium, pers. comm., 1992]) was also retrieved from XU23. The fruit contains the dried, soft tissue, and shows no evidence of fully developed seeds. All of these items come from SU4h or the SU4-SU4h interface zone, indicating that SU4h may have been a different depositional unit to SU4. Coupled with the fact that all of the pandanus nuts and leaves also come from this unit, SU4h is interpreted as having been laid immediately before SU4 was deposited. This took place sometime around 900 years BP. The most parsimonious explanation for SU4/4h may thus be



FIG. 11. Wooden digging stick excavated from Mordor Cave, Square H10, XU22 (photograph courtesy of the Queensland Museum).



FIG. 12. Wooden digging stick: close-up of digging end (photograph courtesy of the Queensland Museum).

that the vegetation-rich SU4h was laid as a single unit. This involved wedging vegetation between boulders devoid of underlying sediments, thereby creating a localised false floor. The digging stick, sheet of cut bark, and the pandanus nuts were then placed on top of this matted vegetation layer, and the whole lot was then covered with more vegetation (containing some hearth remains). The reasons for this are unknown, but ethnographic parallels are known from the Mitchell River delta (pers. obs., 1992; David & Cordell, 1993). Here, Aboriginal people are known to bury people's 'rubbish' (including cherished material items) after their death. It is possible that the Mordor Cave SU4/4h layer relates to a similar practice, although this remains, at this stage, mere speculation.

DISCUSSION OF MORDOR CAVE

Both Squares E18 and H10 contained large amounts of vegetation. Especially notable is the presence of a bracket fungus from XU2 of Square E18, and a fig from XU23 of Square H10 (dated to approximately 900BP). The very large numbers of *A. lathamii* egg shells recovered from both squares, and from all SUs, may also indicate that the site was used on a seasonal basis, and that it was repeatedly re-occupied during the same time of the year (August-December). 2,515 fragments

of egg shell were excavated from Square E18, and 2,340 pieces from Square H10, distributed throughout the excavated sequences. A single brush turkey feather was also recovered from H10 XU3.

It is difficult to relate the E18 stratigraphy to that of H10 given the insufficient number of radiocarbon dates obtained. Nevertheless, the peak occurrence of ochre half-way through the deposit in Square E18, whose base was dated to 1,500BP, equates well with peak ochre deposition rates around 900BP in Square H10, and may indicate that most of the paintings at the site were undertaken around that time. There is no evidence for any rock art activity at the site having been undertaken before approximately 1,500BP. However, a painted pig on the back wall indicates that cave painting continued into contact times.

MITCHELL RIVER CAVE

Mitchell River Cave is a very large cave whose floor is roughly level with the surrounding plains (Fig. 13). It consists of a medium-sized entrance (275m²) which leads to a narrow corridor (344m²) inside a limestone bluff (the Maunsell Tower). In turn, this corridor opens into a large, skylit chamber. Although both the entrance of the cave and the corridor contain evidence of past

human presence (including cave paintings, stencils and a print), the skylit chamber does not.

Test excavations were undertaken at Mitchell River Cave in 1989 for three main reasons:

- 1, the sediments appeared to be deep, offering the potential of long stratigraphic sequences;

- 2, rock paintings occurred adjacent to occupational deposits. It was thus hoped that by excavating beneath the paintings, stratified pigments would be recovered, offering the potential to date the paintings stratigraphically; and

- 3, the southern end of the cave contained rich, ashy surface sediments, promising potentially rich cultural deposits by which temporal trends could be investigated.

The Mitchell River Cave excavations provided the first dated prehistoric evidence from the Mitchell-Palmer limestone belt (David, 1991c). Three test pits were excavated, sampling two different parts of the cave. Test Pits 1 and 2 were located near the rock wall, beneath red paintings along the corridor's northern wall so as to obtain stratified ochres. There was little surface evidence of any occupational debris in this part of the site. Test Pit 3 was located near the entrance of the cave, in an area where surface ash concentrations were high. The cave wall was located

two metres to the east of Test Pit 3, upon which a single small, red anthropomorph was painted. It was excavated specifically to investigate deposition rates of various forms of cultural materials - especially stone artefacts and food refuse - as well as to obtain stratified fragments of ochre. The following analysis is based on results obtained from Test Pit 3 only.

TEST PIT 3

Three relatively distinct SUs were differentiated during excavation and from the sections (see David 1991c for descriptions). Three radiocarbon dates were obtained. Two of these are conventional determinations, and the third is an AMS date. All dates are on charcoal samples. They are:

930 \pm 70BP (Wk-1717). This dates SU2, XU2, and comes from an aggregated charcoal sample collected after sieving. It includes all of the charcoal recovered from between 1.4cm and 5.1cm below the ground surface ($\delta^{13}\text{C} = -25.6\text{‰}$).

1140 \pm 100BP (Wk-1718), dates all of the charcoal collected from SU2, XU4 (between 8.2 and 12.6cm below the ground surface) ($\delta^{13}\text{C} = -24.6\text{‰}$).

15,910 \pm 200BP (R 14062 NZA 1556). This is an AMS date on charcoal from the basal spit



FIG. 13. Mitchell River Cave.

(XU17), located from 67.8 to 71.4cm below the ground surface ($\delta^{13}\text{C}$ equals -23.6‰).

Cultural Materials: Deposition Rates. Deposition rates were calculated for each XU by reference to their interpolated ages (Tables 5, 10, 12; Figs 14, 15). The raw data are presented in Table 11. As was the case for Hearth Cave, however, no detailed geomorphological analysis has yet been undertaken for Mitchell River Cave. Because of this, and because the period between the radiocarbon dates covers a long stretch of time, the $1,140 \pm 100\text{BP}$ trends should be treated with caution, as temporal control is poor.

Amounts of mussel shell, charcoal, stone artefacts, and burnt earth peak in XUs 1 to 6 (SUs 1-2, estimated to date to $0\text{--}3800\text{BP}$), with particularly high concentrations during the upper half of this sequence. A single fragment of ochre was recovered, from XU3. The bone is difficult to interpret without having undertaken detailed taphonomic work, as Mitchell River Cave is currently inhabited by bats, and much of the bone may be the results of localised bat activity.

In addition to the general trend noted above, secondary peaks in deposition rates of cultural materials are also evident, especially of stone artefacts in XU9. It may be that these peaks reflect significant fluctuations in the deposition of cultural items before SU2 times, although they may alternatively indicate that sedimentation regimes have fluctuated through time, and that these have not been adequately considered in the calculation of deposition rates. This issue is pertinent to this site, as well as to other early deposits (see Hearth Cave and Fern Cave), given the poor chronological resolution of most sequences.

The deposition rates for stone artefacts, mussel shells, charcoal and burnt earth thus peak during the late Holocene, and especially during the last two millennia in Test Pit 3. This is so for all cultural materials excavated, and therefore indicates that the timing of major changes in various aspects of social life was roughly contemporaneous, peaking about two thousand years ago. Stone artefact deposition rates are particularly pronounced during this time, although the secondary peak in XU9 remains to be explained. It is suspected that this is the time covering the early Holocene wet period, when sedimentation rates have elsewhere been shown to have been much slower (cf. David, 1987). For example, fine sediments have been washed away from the early Holocene deposits at Green Ant, and this has been explained by an erosional phase (Flood & Horsfall, 1986). At Fern Cave, on the other hand,

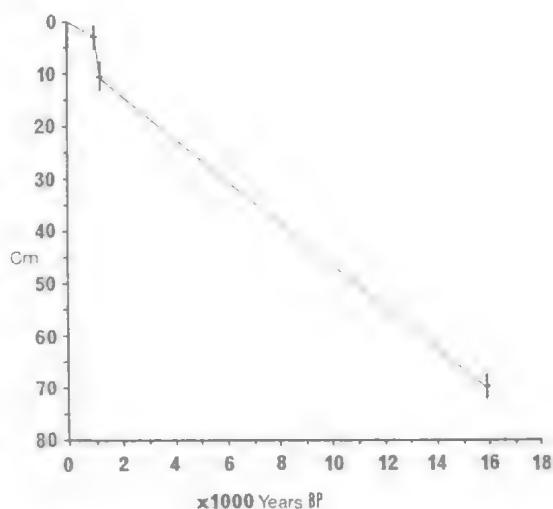


FIG. 14. Mitchell River Cave, depth-age curve. Y axis = cm below ground surface.

the Holocene deposits are shallow, implying very slow deposition rates (David, 1991d). Similar situations of shallow or compacted early Holocene deposits have been observed from many other sites in Queensland, such as Walkunder Arch Cave (Campbell, 1982, 1984), Kenniff Cave and The Tombs (Mulvaney & Joyce, 1965) and Colless Creek (Hiscock, 1984a, 1984b, 1985). In most cases, this has been explained by reference to major environmental changes.

The top of XU9 is calculated to $6,950\text{BP}$ via the depth-age curve, in accordance with a mid to early Holocene antiquity. It may be that here, too, depositional regimes have been different during the early stages of the Holocene. If this is so, the deposition rates estimated for the early Holocene are likely to be in error. The only way this issue can be resolved for Mitchell River Cave will be to obtain further radiocarbon dates from the XUs around XU9. Detailed geomorphological investigations are also warranted.

Only one fragment of ochre was found in Test Pit 3. The openness and large size of Mitchell River Cave, together with the low number of paintings on the cave walls, means that the likelihood of detecting ochres resulting from painting activities in any one part of the site will be small. Given the small size of the excavations in this part of the site, an extension of the Test Pit 3 soundings may be warranted. This would also enable us to define more closely the points in time when the major changes in cultural materials occur.

Stone Artefacts. A single anvil was recovered from XU2. The flaked stone artefacts are amorphous, and no formal stone tool types have been recovered. The most common raw materials are chert, quartz and limestone.

DISCUSSION

The major cultural changes documented from the Mitchell-Palmer region took place during the late Holocene. At Hearth Cave, significant increases in deposition rates of sediments, stone artefacts, ochre, charcoal and bone took place around 3,500BP, while at Mitchell River Cave, similar increases began after approximately 3,800BP.

In assessing the timing of changes in deposition rates and artefact types at the different sites excavated, however, it is worth emphasising that the temporal data are rather coarse grained, except in cases where radiocarbon determinations were obtained at narrow time intervals. Consequently, it is not yet possible to determine whether or not the apparent differences in the timing of changes both within and between sites are significant. For example, do increases in deposition rates occur synchronously at Hearth Cave and Mitchell River Cave, sometime between 3,800 and 3,500BP, or do the changes in each site take place at different times around this period?

Given the coarse grained nature of temporal resolution at Hearth Cave and Mitchell River Cave, it is thus difficult to be specific about the timing of changes in the Mitchell-Palmer area. Nevertheless, these excavations have revealed repeated late Holocene

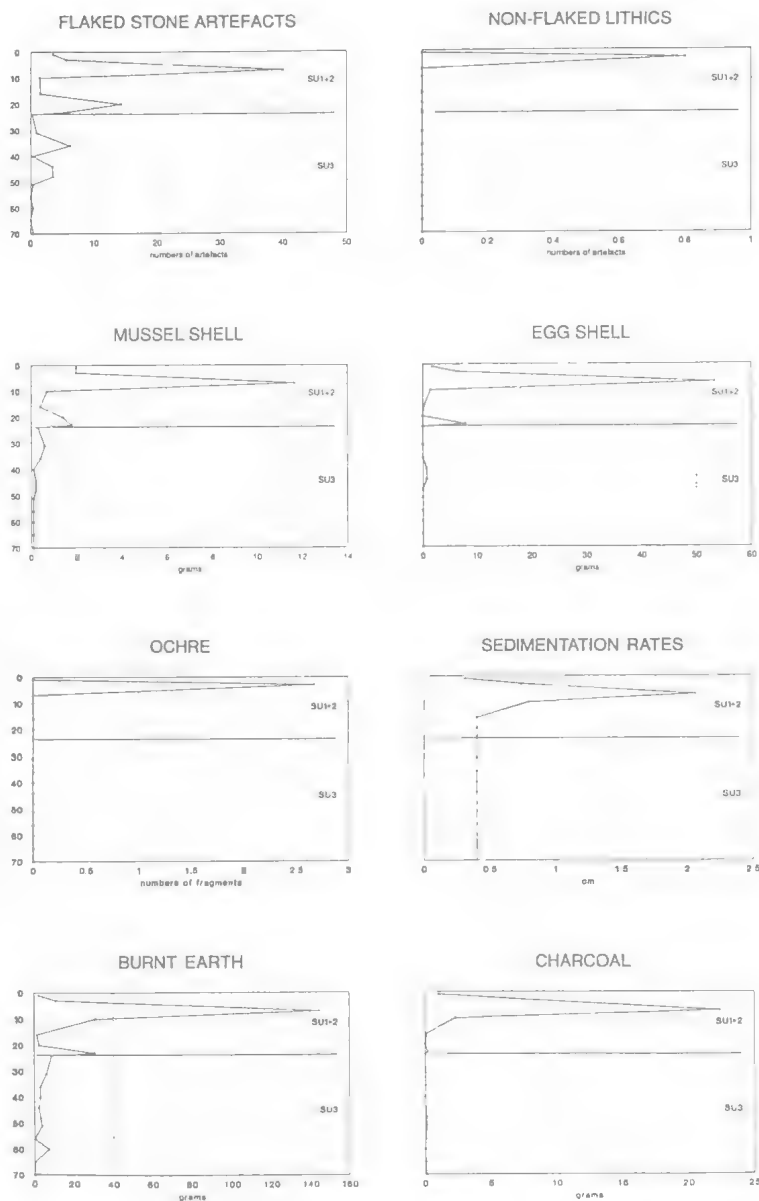


FIG. 15. Mitchell River Cave; deposition rates (per m² per 100 years). Y axis = cm below ground surface.

trends, implying occupational and depositional patterns different to those of earlier times. These trends include increases in the rates of deposition of cultural materials sometime after 3,800-3,500BP, and possibly also a late Holocene start for painting activities at each of the three sites

investigated. Together, these trends may imply increases in intensities of site and subregional use sometime during the mid to late Holocene. However, it should be kept in mind that only four 50cm x 50cm test pits have been analysed from the three sites. This small excavation sample significantly limits our ability to investigate issues such as those relating to foraging strategies, settlement systems, site use and the like. Furthermore, the temporal trends are based on the use of depth-age curves, which are problematic in themselves. Until more radiocarbon dates and geomorphological results are obtained, this issue will not be satisfactorily resolved.

Technological analyses of the stone artefacts have not yet been undertaken, but may prove a fruitful avenue of enquiry into patterns of change and stability both within and between sites and subregions. Such studies are beyond the scope of this monograph. It may be worth noting that the only artefact type recognised from the Mitchell-Palmer excavations was a single burren adze slug, dated to 700-1,100BP, approximately contemporaneous with those found at Laura and in the Koolburra Plateau to the north.

NGARRABULLGAN

Ngarrabullgan (Mt Mulligan) is located on the northern edge of the Featherbed Ranges, between the Mitchell and Walsh Rivers (Figs 16, 17). It is an 18km long, 6.5km wide, table-top mountain rising 400m above the surrounding landscape. Ngarrabullgan is a sandstone formation in a volcanic landscape, appearing as a two-tiered, cliff-lined structure. Rhyolite conglomerates and complex metamorphics surround the mountain, which stands out as a unique feature in a landscape generally devoid of sedimentary lithologies such as sandstones. While the area to the immediate south of Ngarrabullgan is extremely rugged and mountainous (the Featherbed Ranges), to the north it consists of dissected plains, incorporating the nearby valley of the Hodgkinson River.

In 1991, one of us (BD) excavated two caves from the area (Ngarrabullgan & Initiation Caves) (David, 1992a, 1992b, 1992c, 1993b). Analysis of the latter site has only just begun, and the results will therefore not be presented here. Both excavations were undertaken specifically to investigate the antiquity of cave paintings at Ngarrabullgan. In both cases, the excavated squares

were located immediately beneath the painted walls.

NGARRABULLGAN CAVE

Ngarrabullgan Cave is a large sandstone rock-shelter located on top of Ngarrabullgan (Figs 18, 19). The sandstone walls of the shelter consist of silicified coarse sandstones, with little evidence of granular disintegration or block collapse. However, minor exfoliation is evident on some parts of the cave wall.

The site is a long shelter with a very gentle, sloping flat surface. A number of low, flat and very large roof-fall and/or bedrock surfaces occur inside the dripline, rising to approximately 50cm above the surrounding shelter floor. Most of the floor is ashy and devoid of roof-fall or boulders. The eastern end of the site, however, has a number of very large boulders and virtually no occupational deposit.

The overhang at Ngarrabullgan Cave is approximately 3m above ground level, and most of the shelter roof is higher than standing height. Outside the shelter, open woodland on a fairly gentle slope leads directly to a temporary creek some 30m away. Permanent waterholes appear 50m northeast and 100m southwest of the shelter. The shelter is located on the upper slopes of a low ridge, and no scree slope leads into it. Consequently, no colluvial or alluvial deposition takes place in the shelter. The presence of flat, rocky surfaces, largely devoid of loose sediments around the shelter, limits the amount of material that can be picked-up and re-deposited by aeolian processes. Moderate to heavily wooded terrain surrounds the site.

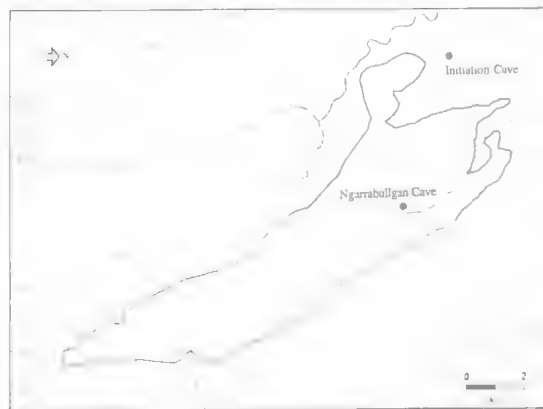


FIG. 16. Ngarrabullgan, showing locations of excavated sites.



FIG. 17. Ngarrabullgan.

Rock paintings are present on the rock walls, and in places the pigment has sunk into the rock matrix. A 50cm x 50cm test-pit (Square M25) was excavated beneath a painted panel. The aim of the excavation was to investigate temporal trends in ochre deposition rates.

Square M25 was excavated in maximum 10 litre bucket spits within stratigraphic units. All cultural material over 2cm maximum size were plotted in three dimensions and bagged separately. All other excavated materials were sieved through 3mm wire-mesh sieves and subsequently sorted in the laboratory. Sediment samples were collected from each XU. The mean thickness of each XU was 3.2cm, and the maximum depth of deposits was 35.5cm, upon which bedrock was reached.

The sediments at Ngarrabullgan Cave are well stratified, with all stratigraphic units being rich in cultural materials, including charcoal. All SUs consist of disintegrated coarse sandstone compacted in an ashy and charcoal-rich matrix (cf. David, 1993b). With the exception of SU1 at the top, all SUs contain coarse, very compact but unconsolidated sediments. There is no evidence of lag deposits in any part of the excavation — that is, there is no evidence of water-worn sediments, size sorting, or truncation of sediments.

RADIOCARBON DATES

Four radiocarbon dates were obtained (Table 13). In all cases, the ^{13}C -adjusted determinations are the same as the standard dates. Beta-47515, 47113 and 45906 consist of charcoal samples collected in situ and plotted in three dimensions, whereas Beta-47849 was an amalgamated charcoal sample from XU9 collected from the sieves. The lowermost individual charcoal sample (Beta-45,906) comes from 4.7cm above bedrock. The internally consistent age determinations represented by the four dates, along with the stratified nature of deposits and the presence of cultural deposits throughout the sequence, suggests that people have lived at Ngarrabullgan Cave since at least 37,000 years ago.

CULTURAL MATERIALS

It is not known whether or not the sequence at Ngarrabullgan Cave contains any depositional hiatuses, but this is deemed likely, given the radiocarbon dates obtained. Pending on the results of forthcoming geomorphological investigations, we interpret the depositional history of the site as largely, if not entirely, relating to periodic fire (hearth)-induced disintegration of the cave wall, and to other human activities relating to occupa-



FIG. 18. Ngarrabullgan Cave.



FIG. 19. Ngarrabullgan Cave, excavations in progress, 1993.

tion of the site. The probable presence of depositional hiatuses makes it unrealistic to infer regular sedimentation rates between the radiocarbon dates obtained, and therefore deposition rates for cultural materials have not been calculated.

Cultural materials are relatively abundant in the upper units, SUs 1 and 2 (dating to the last $5,410 \pm 60$ years BP). It is during this time also that most of the ochre, including all of the fragments possessing use-striations, appear. Within this broad pattern of change, however, major continuities are also evident. The most striking of these concerns the proportions of stone raw material types used: approximately half of all stone artefacts from each spit of the mid to late Holocene layers are made of a dark raw material initially identified as basalt (David, 1993b) (XUs 1-4, consisting of 46.3% to 56.9% 'basalt') (this raw material is currently undergoing petrographic analysis as its precise identification remains uncertain [Bob Bultitude, Dept of Minerals & Energy, pers. comm., 1995]), while 48.9% of flakes from the Pleistocene layers are made of this same raw material. 'Basalt' does not occur in the immediate vicinity of the site, but has to be introduced from the base of the mountain (probably from the southern end). Good quality chert nodules occur in abundance in the immediate vicinity of the cave.

Artefacts made of 'basalt' show no clear changes during the entire occupational history of the site. This is so of all variables analysed that are related to reduction behaviour (degrees of decortication, mean elongation, mean weights and mean thickness:length ratios) (David, 1993b).

Most 'basalt' artefacts from all spits possess no cortex (decortication stage 3), implying that pre-worked, curated stone may have been transported to the site (the small sample size notwithstanding). This issue may warrant further investigation, given its implications for the position of Ngarabullgan Cave in broader settlement-subsistence systems. In particular, it may enable us to ask questions that relate to changing patterns of resource exploitation through time.

Current investigations by Dr R. Fullagar (Australian Museum, pers. comm., 1993) have revealed a number of modified artefacts under low magnification. In addition to use-wear, both plant and animal residues have been identified on the artefacts. These results will be presented elsewhere at a later stage.

Most of the bones obtained from the excavation were burnt. This was the case for all XUs where bone was obtained, although unburnt bone was

also obtained from most spits. There is no evidence that the bones from the upper spits were preferentially preserved, in the sense that they all show similarly low degrees of mechanical damage, beyond burning and pre-burning breakage. Most of the identifiable bones are from small to medium-sized mammals, although few of them are diagnostic (see David, 1993b).

CONCLUSIONS

A two-fold distribution of cultural deposits has been identified from Ngarabullgan Cave. The Pleistocene levels contain relatively low numbers of artefacts in a well stratified matrix, with human occupation beginning sometime before 37,170BP. The absence of snapped 'basalt' artefacts from the Pleistocene levels of the test pit at Ngarabullgan Cave indicates that the site may have witnessed little foot traffic during the late Pleistocene, re-enforcing our confidence in the stratigraphic integrity of excavated finds (cf. Hiscock, 1985). The mid to late Holocene deposits contain fragments of ochre which, given the location of the excavated pit beneath a painted rock surface, are likely to directly relate to the paintings on the wall.

Ngarabullgan Cave contains evidence of intermittent occupation, with a major stratigraphic break immediately below the $5,410 \pm 60$ BP date. It is not yet known what length of time this stratigraphic break represents, but it is worth emphasising that it is not associated with any lag deposit, nor with any other evidence for an erosional phase. Detailed geomorphological investigations are currently under way by Dr R. Roberts (Australian National University).

An extension of the original excavation was undertaken in June 1993 in order to further investigate the Pleistocene deposits (David, 1993a). The results will be reported elsewhere.

INITIATION CAVE

Initiation Cave is a medium-sized rhyolite conglomerate shelter located at the base of Ngarabullgan (note that due to cultural restrictions, photographs of this site cannot be shown). Surface sediments are very soft and ashy. B. David excavated at Initiation Cave in 1991, after it was noticed that a section of the sediments had been disturbed and exposed by pig-rooting. The localised disturbance revealed evidence of finely stratified deposits with considerable depth. An excavation was therefore attempted in the hope that the fine stratification, and the depth of the

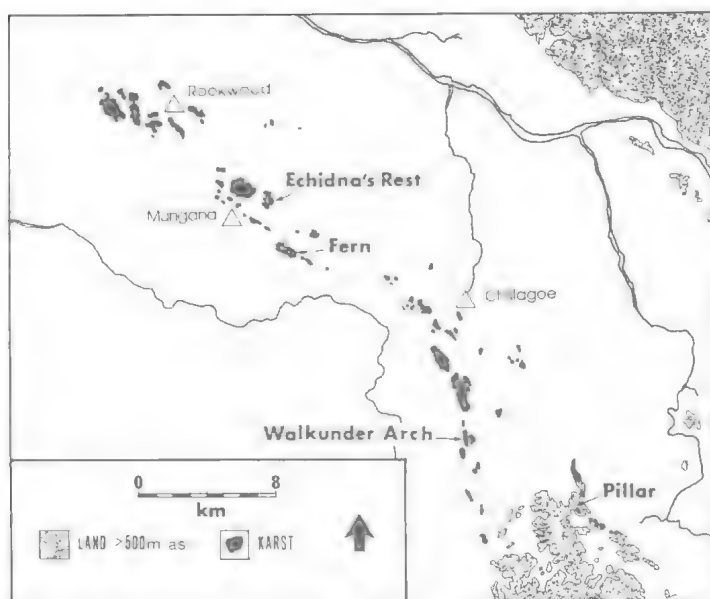


FIG. 20. The Rookwood-Mungana-Chillagoe limestone belt, showing the location of excavated sites.

deposit, would reveal a long sequence with the potential for fine temporal differentiation.

Six 50cm x 50cm squares were excavated against the back wall and under a painted panel, following the same methods used at Ngarrabullgan Cave. The materials have not yet been analysed and will form the subject of a separate report. A basal occupation date of $4,110 \pm 70$ BP (Beta-45772) has been obtained, immediately overlying a thick, culturally-sterile layer. Based on impressions gained during the excavation, the post- $4,110 \pm 70$ BP units are rich in cultural materials, with no obvious changes in depositional trends. Stone artefacts are amorphous, and no formal types have yet been identified.

DISCUSSION

Information available so far on the prehistory of Ngarrabullgan rests largely on Ngarrabullgan Cave. Although further material is forthcoming from Initiation Cave, the site still remains to be analysed, and therefore currently provides little assistance in the formation of a subregional prehistory. Nevertheless, the trends observed at Ngarrabullgan Cave present firm evidence of increased deposition rates for cultural materials after $5,410 \pm 60$ BP, even though the cave has been in use since at least 37,170BP. Furthermore, the well-stratified nature of deposits at the site,

and the absence of erosional episodes, implies that the archaeological trends observed are probably a reliable indication of the site's occupational history.

An initial occupation of Initiation Cave some $4,110 \pm 70$ years ago is in line with a mid Holocene change in occupational strategies in the region (as was implied by changes in deposition rates during mid Holocene times at Ngarrabullgan Cave). At the same time, however, it is not truly synchronous with the changes documented from Ngarrabullgan Cave. At Ngarrabullgan, the only two sites excavated show that major changes began to take place at various times between around 5,400 and 4,100BP. This possible lack of synchronicity will be further explored below.

THE ROOKWOOD-MUNGANA-CHILLAGOE LIMESTONE BELT

Five kilometres south of the Mitchell River, along the western slopes of the Great Dividing Range, the Mitchell-Palmer limestone belt disappears beneath the ground, re-appearing 20km to the south, near the Walsh River (Fig. 20). Here, it occurs as a narrow northwest-southeast belt of limestone known as the Rookwood-Mungana-Chillagoe limestone belt, geologically part of the Chillagoe Formation. The most conspicuous features of the Chillagoe Formation are the massif fossiliferous limestone bluffs, characterised mainly by near-vertical tower karsts, and consisting of intercalated clastic sediments and cherts. The bluffs often exceed 300m in length, jutting out of the surrounding landscape as rugged peaks reaching up to 100m in height (Fig. 21). The maximum width of the exposed formation is 11km, 5km south of Chillagoe.

The Rookwood-Mungana-Chillagoe and Mitchell-Palmer limestone belts share a common geological heritage, having been laid-down during the Upper Silurian and Lower Devonian (approximately 400 million years ago) in a shallow reef environment, at a time when the



FIG. 21. Limestone bluffs, Rookwood-Mungana-Chillagoe area.

coastline could be found 130km west of its present location (de Keyser & Wolff, 1964). The many rockshelters which occur among the limestone towers often show evidence of human occupation in the form of soft, surface ashy deposits, stone artefact scatters, food remains and rock art. Investigations in the Rookwood-Mungana-Chillagoe area began when Robert Broom (later of the Transvaal Museum) went in search of fossils while working as a medical practitioner at Chillagoe in 1892. It was not until 1963, however, that systematic research began, when R.V.S. Wright excavated a rockshelter near the Chillagoe township. Although this site has never been fully analysed, it is reported to contain few cultural remains (Wright, 1971). This site was not dated as no charcoal was found (Wright pers. comm., 1991).

Seventeen years elapsed between Wright's excavation and the next archaeological investigations at Chillagoe. During the early 1980s, Campbell began long-term studies at Walkunder Arch Cave, located in the southern parts of the limestone belt (Campbell, 1982). A number of honours theses have focused on the Walkunder Arch Cave material (Birkett, 1983, 1985; David, 1983, 1984a, 1984b) and, more recently, a num-

ber of researchers have undertaken independent projects in the area (e.g. David, 1987; Mardaga-Campbell, 1986). These investigations will be described following a description of our own excavations at Fern Cave.

FERN CAVE

Fern Cave is a large cave perched above the pediments of Spring Tower, a massive fossiliferous limestone karst formation located 10km northwest of Chillagoe (Figs 22, 23). The cave overlooks Spring Creek, a seasonal water-flow bordered by vine thickets some 30m beneath it. It consists of two high, domed chambers, the floors of which cover 1,056m². Today, flowstone and clay cover the floor of the dark back chamber. Flowstone also occurs in a small area towards the rear of the main (entrance) chamber.

The entrance to Fern Cave involves a steep climb up the boulder-strewn pediments, into a large, cavernous opening. Numerous large boulders at the cave mouth act as a sediment trap. Excavation of Fern Cave was undertaken in 1985 for B. David's M.A. thesis (which involved the excavation of three adjacent 50cm x 50cm pits) (David, 1987) and in 1989 for his PhD research (four



FIG. 22. Spring Tower, with the entrance to Fern Cave visible above the tree-line.



FIG. 23. Fern Cave: the main (entrance) chamber.

50cm x 50cm pits). The 1985 material was heavily encrusted in calcium carbonate, and was not analysed. The 1989 excavations were undertaken in an attempt to obtain less encrusted materials. As the original excavation was located close to a localised drip point, which probably encouraged the development of calcium carbonate nodules within the deposit, the 1989 excavations were located at some distance from known drip points. They were undertaken in ≤ 5 cm spits, with cultural materials ≥ 2 cm maximum size plotted in three dimensions and bagged separately. The residue was sieved in 3mm mesh wire sieves. Sediment samples were collected from each spit of each square.

Both the 1985 and 1989 digs were located immediately inside the boulders near the cave mouth, where soft sediments appeared to be at their deepest and least disturbed. As expected, the 1989 excavations contained little evidence of calcium carbonate encrustation. The following is based on the analysis of Test Pit 4 from the 1989 excavations. Preliminary examination of materials from the other squares are consistent with the conclusions presented here.

STRATIGRAPHY AND DATING

The following stratigraphic descriptions supercede those of David (1991d). A detailed report on sediment thin sections and mineralogy by Dr J. Magee (Department of Archaeology & Natural History, RSPAS, Australian National University) will be published elsewhere.

Five stratigraphic units (SU1, SU2a, SU2b, SU2e, SU3) were identified from Test Pit 4 (Table 14, Fig. 24). All SUs contain stratified cultural materials except for SU3. The results of the geomorphological analyses support the interpretation of SUs 1 and 2 (but not SU3) as being associated with human activity (Magee, 1993).

Four radiocarbon dates were obtained from Test Pit 4, and one from the original 1985 excava-

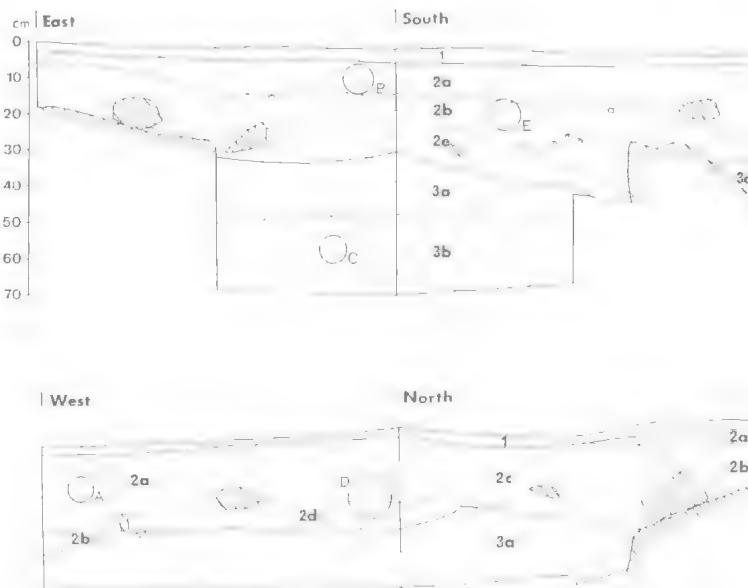


FIG. 24. Fern Cave: section drawings. Test Pit 4 is the deepest square (represented on the eastern and southern sections). The circles represent the locations of the oriented sediment samples.

tion (Test Pit 3) (Table 15). All of the radiocarbon dates were obtained from materials collected from the sieves, and hence none are spot dates. Beta-33921, the only charcoal date obtained, comes from all of the charcoal obtained from XU1 in Test Pits 4, 6 and 7. All the other dates come from samples of the land snail *Xanthomelon pachystylum*. Six points relating to the stratigraphy and dating need elaboration:

1, occupation at Fern Cave began sometime before 26,000 years ago. Extending the depth-age curve to the base of occupation, 3.0cm below the $25,710 \pm 490$ BP date, suggests c.29,000BP for the start of occupation at the site (Fig. 25), although this now needs to be tested with further radiocarbon dates (forthcoming).

2, some 33cm of sediment have accumulated since the first evidence of human occupation in Test Pit 4. This implies an average sedimentation rate of 1.2cm/1000 years. Although this is low, sedimentation rates vary from 3.3cm/1000 years during times of peak occupation, to 0.6cm/1000 years during periods of less intensive use (see below). Such low sedimentation rates are not surprising, since sediments are unlikely to enter the cave except through animal or human agency (and retained largely by the presence of large boulders near the entrance of the cave, acting as a sediment trap).

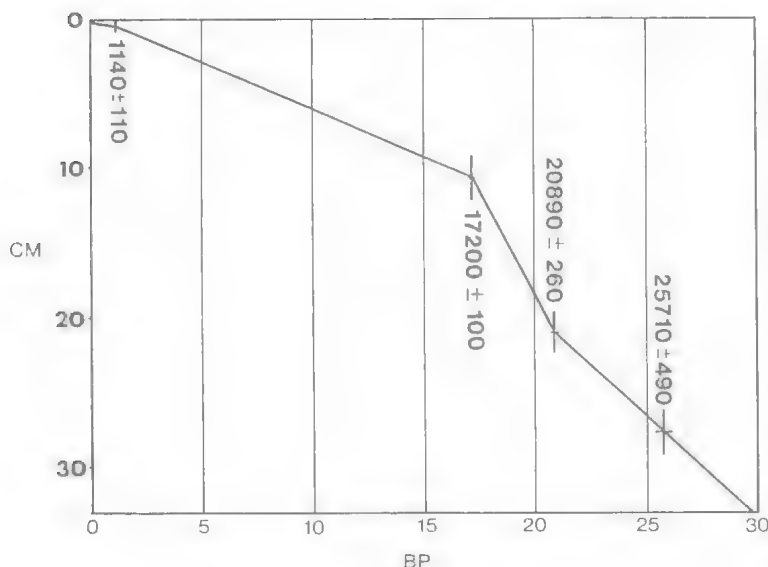


FIG. 25. Fern Cave: depth-age curve for Test Pit 4. X axis = years BP x 1000, Y axis = centimetres below the ground surface.

3, the reliance on land snail (*X. pachystylum*) dates is problematic given their largely unknown reliability for dating. However, the Fern Cave dates are likely to approximate charcoal dates for two reasons. Firstly, a control sample of *X. pachystylum* from Echidna's Rest was submitted for dating. Echidna's Rest is a rockshelter located in the same geological formation as Fern Cave (see below). The sample was collected from XU1 of Layer 1 (Test Pit 4), where a charcoal date of 690 ± 90 BP (ANU-4812) had previously been obtained (see David, 1990a). The land snail gave a reading of $1,150 \pm 60$ BP (ANU-7015), suggesting that a discrepancy of c.450 years may exist between charcoal and land snail dates. We have not compensated for this in the analysis below, however, as the precise error factor which can be expected for *X. pachystylum* dates is still unknown. J. Head (Australian National University, pers. comm., 1991) has suggested that an error margin of up to 2,000 years can be expected.

Secondly, the Pleistocene levels of Walkunder Arch Cave were also dated on land snail samples (presumably *X. pachystylum*) (Campbell, 1982) (see below). Walkunder Arch Cave is also located within the same geological formation as Fern Cave, so the error factor on land snail dates is likely to be of a similar order of magnitude. The Walkunder Arch Cave land snail dates follow a long sequence of charcoal dates, and appear to be of an acceptable age range (Campbell, 1982).

Nonetheless, the use of land snails for dating remains problematic: *X. pachystylum* is known to burrow, and the softer the sediments, the deeper the burrowing is likely to be (J. Stanistic, Queensland Museum, pers. comm., 1991). However, in compact sediments such as those of Fern Cave, snails are unlikely to burrow to any great depth. This is further highlighted by the absence of any live shell from the excavations at Fern Cave. Free-sealing snails usually secrete a calcified mucus membrane to stop dessication, but *X. pachystylum* does not do this. It frequents humid areas, and generally avoids burrowing in dry sediments due to the dangers of dessication. The Fern Cave

sediments were relatively dry in the excavation area, and are therefore unlikely to have been conducive to *X. pachystylum* burrowing (P. Coleman, Australian Museum, pers. comm., 1987; J. Stanistic, Queensland Museum, pers. comm., 1991). The implications are that the shells died on or near ancient surfaces, rather than being the result of post-depositional intrusions.

Many of the *X. pachystylum* fragments used for dating were extensively burnt. Unless the shells were alive underneath the ground, and burnt by overlying hearths, the snails are likely to have been deposited as burnt shells in the same stratigraphic contexts as found when excavated. If the former is the case, they would be later intrusions (living specimens buried and burnt in older deposits), and would thus be younger than their stratigraphic contexts. No hearths were noted in the Fern Cave excavations.

4, the dates obtained have been adjusted to take into account ^{13}C values, which indicate no significant amounts of contamination from carbon sources such as the local limestone. However, land snails need a constant intake of calcium, and may achieve this by consuming calcium carbonate from the local rock, which contains ancient carbon. It is for this reason that J. Head has suggested that land snail dates can be expected to be up to 2,000 years in error (also C. Murray-Wallace, University of Sydney, pers. comm., 1990).

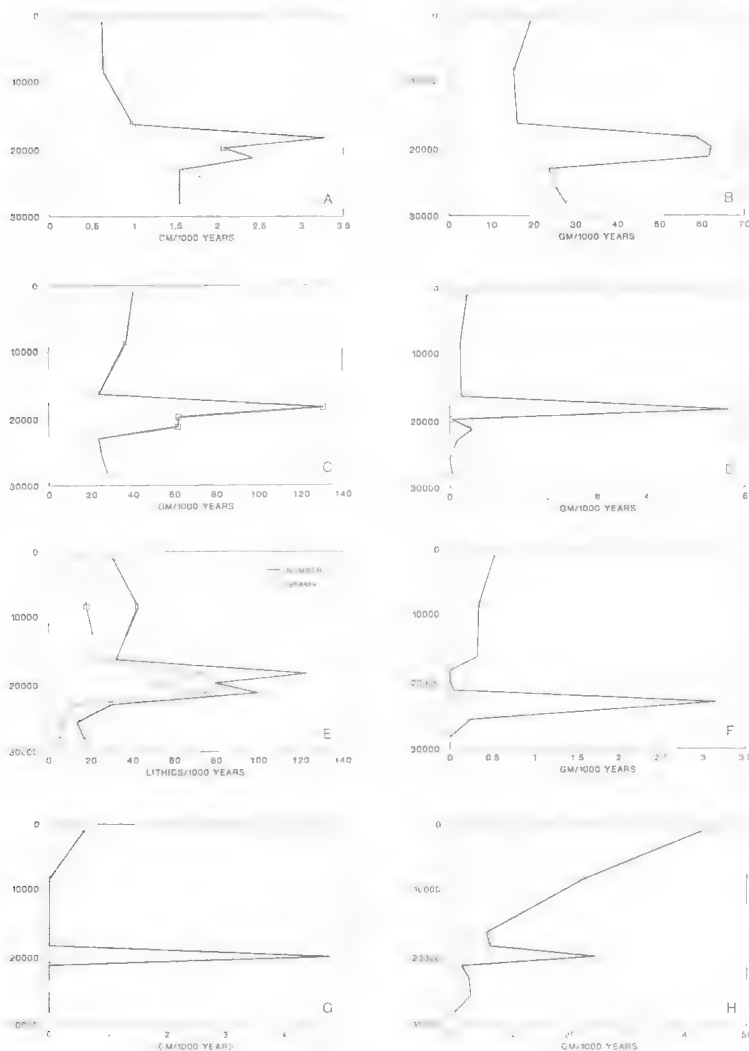


FIG. 26. Fern Cave: Test Pit 4, deposition rates. A = sedimentation rates, B = land snails, C = bone, D = mussel shell, E = stone artefacts, F = charcoal, G = burnt earth and burnt stone, H = ochre.

5, an examination of the mineralogy of stratified land snail shells from Fern Cave by Dr J. Magee (Australian National University, pers. comm., 1992) has revealed no evidence for re-working of carbon through re-crystallisation of the shell. This is an important point, as it virtually eliminates the chance that carbon from the dated shells has been fractionated by re-crystallisation.

6, the entire Holocene sequence is compacted into 6cm of deposit. A similar problem was faced at Colless Creek by Hiscock (1984a) and, as already mentioned, numerous other sites in northern Australia also have compacted early to mid Holocene deposits (e.g. Kenniff Cave and The

Tombs [Mulvaney and Joyce, 1965], Walkunder Arch Cave [Campbell, 1982], Early Man [Rosenfeld et al., 1981]). In most cases, this is believed to reflect an erosional phase caused by a period of increased rainfall from approximately 8,000 to 3,000 years ago. At Fern Cave, however, there is no evidence of an erosional phase, nor of a depositional hiatus. Cultural materials show no evidence of water damage, the mean size of sediment particles is no greater than underlying sediments, and there are no signs of stratigraphic discontinuities. It is likely that the Holocene period simply witnessed slower sedimentation rates, possibly in direct relation to lower occupational intensities at the site.

CULTURAL MATERIALS: DEPOSITION RATES

The cultural materials excavated from Test Pit 4 are listed in Table 16. Deposition rates were calculated from this raw data, following the method outlined above (that is, via reference to the depth-age curve; Fig. 25, Table 17) (Table 36). Although deposition rates have been calculated for the duration of occupation at Fern Cave (Test Pit 4), it must be stressed at this stage that these rates should only be treated as gross estimates (Table 18). This is especially so for the post-17,200±100BP excavation units. The reason for this is that these units possess poor chronological control as a result of insufficient radiocarbon determinations. The following discussions, therefore, should be treated with this problem in mind. Following initial occupation of Fern Cave, perhaps around 29,000 years ago, the deposition rates of all cultural materials were low until the onset of the last glacial period, around 22,000 years ago (Fig. 26). The glacial maximum (which is represented at this site by the period 22,000-17,000BP) saw peak deposition rates of stone

artefacts, bone, mussel shell, burnt earth, and burnt stone. Peak sedimentation rates accompanied the increased rates of deposition of cultural materials.

Interpreting the Trends in Deposition Rates of Cultural Materials and Sediments. The last glacial maximum corresponds to the most arid time of the last 40,000 years. The presence of low sea levels at that time, and the exposure of the Sahul Shelf, are believed to have reduced convection around the present sea-board, resulting in the formation of drier air masses and decreased precipitation throughout much of Cape York Peninsula.

Evidence for a more humid period immediately preceding the arrival of humans at Fern Cave (c.29,000BP) appears in the form of flowstone detritus in XU10 (SU3), immediately below the basal occupation layer (see David, 1991d). The return of increasingly more humid conditions following the glacial maximum (after c.17,000BP) is associated with a significant decrease in the deposition rates of cultural materials. Bone deposition rates decrease six-fold, stone artefacts three-fold, and burnt earth and stone disappear altogether after that time. With the exception of ochre, these low levels are maintained throughout the period following the glacial maximum.

STONE ARTEFACTS AND ROCK ART

The stone artefacts from Test Pit 4 were recently examined by Lara Lamb for her honours thesis at the University of Queensland (Lamb, 1993). Her analysis focused on technological rather than typological issues (no recognised artefact types were identified from Fern Cave). Her aims were to determine whether or not the peak stone artefact deposition rates reported by David (1991d) could be explained by changes in methods of stone artefact production. She thus identified a number of attributes that could be directly related to specific behavioural practices. These included some that could be attributed to technological practices, and some that related to the subsequent modification of artefacts as a result of changes in site use (e.g. burning, trampling). Her results showed significant increases in activities such as burning and trampling during the height of the last glacial maximum (c.22,000-17,000BP), as well as a reduction in the use of quartzite and increased use of chert at that time. Chert can be found in the immediate vicinity of Fern Cave, but quartzite cannot (it's closest source is more than 10km away).

Lamb's results indicate peak use of Fern Cave during the arid phase, c.22,000-17,000BP. A

number of permanent springs currently occur within 2km of Fern Cave, a feature of the local landscape that may have attracted people to the area at that time. One implication of these results is a possible narrowing of resource catchments during the height of the last glacial maximum. This issue is currently being further explored by Lamb and David, and will be reported elsewhere.

The very large amounts of ochre excavated from the Holocene deposits suggests that certain forms of artistic activity were concentrated during this time. This is in contrast to low deposition rates of all other cultural materials at this time. The implications are that while occupational intensities may have decreased following peak aridity during the last glacial maximum, people continued to use the site, albeit in a different way. While occupational intensities probably decreased, activities using earth pigments (painting/stencilling) appear to have increased sometime during the Holocene. Given that the Holocene deposits are contained within only two excavation units (the second of which also contains Pleistocene deposits), it is not possible, at present, to further define the timing of these events.

CONCLUSION

The coincidence of high occupational intensities and peak aridity during the glacial maximum at Fern Cave may not be fortuitious. Permanent springs presently occur near Fern Cave, and water can also be found year-round within the site in the form of dripping water. Consequently, occupation at Fern Cave was at its most intensive from 22,000 to 17,000 years ago, when the availability of water may have been most critical to settlement location. It is not yet known whether such a focus on Fern Cave and its immediate vicinity was a (dry) season or a year-round phenomenon.

As the cave gradually became less habitable due to increasing levels of humidity (especially during the early Holocene), and as surface water in surrounding areas became more widespread, the use of Fern Cave as a base camp decreased. Its importance in the overall settlement system was nevertheless probably maintained by a shift in site activity, losing importance in the domestic domain, and gaining significance in fields related to cave-painting activity.

ECHIDNA'S REST

Echidna's Rest is a large rockshelter situated at the base of the Queenslander Tower, a large lime-

stone bluff located 20km northwest of Chillagoe. It contains a large, skylit opening in an above-ground limestone karst formation, with near vertical walls up to 30m in height. The rockshelter created by the skylit chamber can be reached by a single, small opening in the rock wall at ground level.

Most of the shelter's surface is flat, with 208m² of the soft surface lying outside the dripline, and 94m² sheltered within it. The area outside the dripline has some grass cover and occasional trees. Cultural deposits occur only within the main chamber of the rockshelter complex. Fine, ashy surface sediments are restricted to a localised area within the dripline. The site was partially excavated by one of us (BD) for a Masters thesis in 1985 (David, 1987, 1990a), and has since been largely re-analysed. No excavation was attempted outside the dripline, although all surface artefacts were plotted and collected (David, 1987).

Twelve 50cm x 50cm squares were excavated, representing 4% of the soft ashy deposits. Eleven of the squares were juxtaposed to form a trench, while the other was located 1m south and 1.5m west of the main trench (see David, 1990a). The trench was located in an area devoid of macropod surface disturbance, and oriented to span the width of the shelter from dripline to back wall.

The excavation was undertaken in maximum 5cm spits following the stratigraphy. Spits from each stratigraphic unit were numbered independently from previous SUs (e.g. SU1 XU1, SU2 XU1, SU2 XU2, etc.). All bones over 2cm maximum length, and all artefacts noted in situ, were recorded in three dimensions and bagged separately. Excavated sediments were sieved through 1mm wire mesh sieves and subsequently sorted in the laboratory.

STRATIGRAPHY AND SEDIMENTS

Three major SUs were identified (SU1, SU2, SU3). In Square 12, SU2 was sub-divided into two sub-layers, although it remained undifferentiated in the main trench (David, 1987). Both SU1 and SU2 sediments are rich in organic carbon (present mainly as ash and charcoal), in accordance with their rich cultural associations. There is a direct correlation between humidity levels and amounts of carbonate in the deposits, but this is not surprising given that calcium carbonate enters the soil through percolating water.

The *Echidna's Rest* sediments contain large numbers of cave pearls. Cave pearls are inorganic calcite formations which form in the vadose (above ground-water) zone with the influx of fresh water.

They are created under low energy environments in humid tropical and subtropical climates, and are characterised by composite nuclei formed chemically by evaporation (Flügel, 1982: 128, 149). Stable conditions within the limestone environment are critical to their formation (Walensky, Australian National University, pers. comm., 1987).

The abundance of cave pearls in each spit of each square was estimated by allocating a rating of 1 for low abundance, 2 for medium, and 3 for high. The mean abundance rating was then calculated for each spit of each stratigraphic unit. SUs 1 and 2 contained large amounts of cave pearls, while very low numbers were found in SU3 (all spits). This may imply relatively stable environmental conditions during SU1 and SU2 times, conditions conducive to the formation of cave pearls.

RADIOCARBON DATES

Seven radiocarbon dates were obtained (Table 19). All are from good charcoal samples and each was collected in situ. There is general agreement between the dates obtained. Dates of 690±90BP (ANU-4812) for the base of SU1, and 710±120BP (ANU-4809) and 730±200BP (ANU-4815) for the top of SU2 suggest a change-over from SU2 to SU1 around 700BP. A date of 2,440±150BP (ANU-5155) was obtained from near the base of SU2, along with a date of 2,120±150BP (ANU-4810) above it. Given the stratigraphic provenance of the radiocarbon dates, it is likely that SU2 began around 3,000 years ago. Unfortunately, a lack of adequate charcoal has meant that radiocarbon dates have not been obtained from SU3. Its antiquity is therefore unknown.

If the SU2/SU3 interface reflects changes in environmental conditions, then its inferred antiquity of around 3,000BP accords well with palaeoclimatic reconstructions obtained from nearby areas. Kershaw's (e.g. 1975a) work especially points to an increase in rainfall during the early Holocene, followed by a decrease around 3,000BP. This is also supported by the low density of cave pearls recovered from SU3, implying unstable environmental conditions at that time. The distribution of various species of land snails down the deposit is also consistent with this interpretation (David & Stanisic, 1991). The implication is that SU3 contains materials deposited during the early to mid Holocene (David, 1990a).

CULTURAL MATERIALS

No attempt was made to estimate deposition rates of cultural materials, as the antiquity of SU3 is unknown. Quantities of cultural materials were thus standardised by calculating the amounts of materials obtained per amount of sediment excavated for each SU (David, 1987) (Table 20).

Burnt Ant Bed, Burnt Earth and Burnt Stone. Burnt ant bed was present throughout the upper spits. SU2 contained more burnt material than either SU1 above it or SU3 below it. This was expected given that an in situ hearth was excavated from SU2 XU2.

Ochre. Sixteen ochre fragments were recovered. All are less than one gram in weight, and include yellow, orange, red and mauve fragments. Most of the ochre came from SU1 (<700BP), although no use-worn pieces were identified.

Egg Shell and Mussel Shell. The only animal remains, other than terrestrial fauna, attributable to human activity are egg shells and mussel shells (*Velesunio* sp.). Eight pieces of egg shell are present (species unknown, but not emu), each weighing 0.1g or less. Most pieces are unburnt. Mussel shells are uncommon in all SUs. Their poor representation cannot be attributed to preservational factors, given the ideal preservation conditions at Echidna's Rest. Egg shell and mussel shell peak in SU2 and SU1.

Bone. Bone occurs in all of the excavated spits, but increases significantly after c.3,000BP. This overall increase is associated with an increase in proportions of burnt bone, which peak during SU2 XU2 times (the hearth layer). Burnt bone shows extensive evidence of calcination. This can only occur through heating under temperatures rarely reached under natural conditions. Furthermore, a significant proportion of the burnt bone has a bluish-grey tinge, obtained when 'green' bone is burnt (David, 1990b). These factors point to the burning of food refuse by the occupants of Echidna's Rest, and this is especially so of SU1 and SU2 times (i.e. after c.3,000BP).

Twelve species of animals were identified (Table 21). They include rodents, bandicoots (*Isodon* sp.), rock wallabies (*Petrogale* sp.), wallaroos (*Macropus robustus*), possums (*Trichosurus vulpecula* and *Pseudocheirus peregrinus*), lizards (AGAMIDAE, GEKKONIDAE, SCINCIDAE), snakes (ELAPIDAE, BOIDAE) and birds (AVES). However, none of the lizard or rodent bones are burnt. Given that lizards and rodents inhabit the local caves today, they are not interpreted as being the result of cultural activity in the site. Similarly, the single bird long bone from SU1 is fresh in ap-

pearance (and unburnt), and is likely to have been naturally introduced into the site.

The range of species represented at Echidna's Rest is very similar to that from the late Holocene layers of Walkunder Arch Cave nearby (Campbell, 1982; David, 1983, 1984a, 1984b) (see below). The latter are dated to the last 3700 years BP (Campbell, 1982). In both cases, there is a predominance of *Petrogale* sp. and *Isodon* sp., with most rock wallabies from the Walkunder Arch Cave assemblage having their fourth molar partially or fully erupted (41 out of 43 MNI) (David, 1984a). All of the species present at Echidna's Rest, and all of those from Walkunder Arch Cave, with the exception of a small number of freshwater mussels, three *Macropus agilis*, one fish and one crab, were obtained from or near the limestone zone (see below). *Macropus robustus* and *M. agilis* are rare in both sites, implying that during the last 3,700 years or so, the plains, hills and creeks surrounding the limestone outcrops were not an important food resource zone while the limestone caves were being occupied. Coupled with a well defined targetting of the limestone karst fauna, the late Holocene foragers of the Chillagoe region appear to have concentrated their hunting activities on older members of the rock wallaby population. The Echidna's Rest and Walkunder Arch Cave faunal remains may thus reflect a focused hunting strategy. If such a strategy existed, it appears to have been employed continuously from at least 3,700BP to the ethnohistoric present.

Bone Tools. Six bone artefacts were excavated. They all came from SU1 and SU2, and consist of four ground uni-points and two ground spatulae made from macropod fibulas.

Stone Artefacts. 3,669 stone artefacts were excavated from Echidna's Rest, 96% of which weigh less than 2.0g. Of the 96 flakes weighing 2.0g or more, 52 (54%) exhibit retouch or use-wear.

There are thirteen formal stone artefacts, falling into five formal types and representing 0.4% of the assemblage. They include two backed flakes, one small fragment of edge-ground axe (0.4g), one thumbnail scraper, and nine burren adzes (Fig. 27). Although backed flakes are rarely found in northern Australia, Campbell (1982) has reported their occurrence from Walkunder Arch Cave's Pleistocene deposits.

The main formal tool type at Echidna's Rest is the burren adze. All burren adzes come from SU1, and therefore date to the last 700 years or so. Ventral surfaces are characteristically convex, and the modified edges occur laterally to the

striking platform. The edge wear includes deep and extensive step fracturing of a type identified by Kamminga (1982, pers. comm., 1987) as created by the working of hardwoods. Edge angles are consistently between 60° and 80° , with scalar retouch and intrusive step fracturing along a large portion of the margins. Artefacts show clear signs of reduction through both use wear and retouch.

While quartz (36.9% of assemblage) and indurated mudstone (29.2%) were the most common flaked raw materials, limestone (19.6%), chert (12.2%), chalcedony (1.9%), ironstone (<1.0%), quartzite (<1.0%), conglomerate (<1.0%), and obsidian (<1.0%) were also used. The latter is particularly interesting in that it is a true glassy obsidian, representing the first such occurrence in a mainland Australian archaeological site (David et al., 1992). There are no clear signs of changes in the raw materials used during the course of occupation at Echidna's Rest.

All of the burren adzes were made on indurated mudstone. Indurated mudstone artefacts also show occasional signs of heat treatment in the

form of potlids, which make up 5.9% of the indurated mudstone artefacts (N=61 potlids, with 31 from SU1, 20 from SU2, and 10 from SU3). Selective heat treatment of a single raw material may imply that indurated mudstone was a function-specific material, and this is supported by their use for adze-making. It is unlikely that the potlids were accidentally formed when camp fires were lit over existing buried artefacts, as other raw materials could be expected to have been affected as well (especially chert), and there is no sign of this.

In addition to the initial appearance of burren adzes, there are also further important differences between the stone artefacts of SU1 and SU2:

- 1, there are five times as many stone artefacts deposited per unit time in SU1 than there are in SU2, and seven times by weight;
- 2, the proportion of modified artefacts in SU1 is one and a half times as great as in SU2;
- 3, there is a greater intensity of stone use, as measured by edge length per gram of stone and by edge length per number of tools, in SU1. SU1

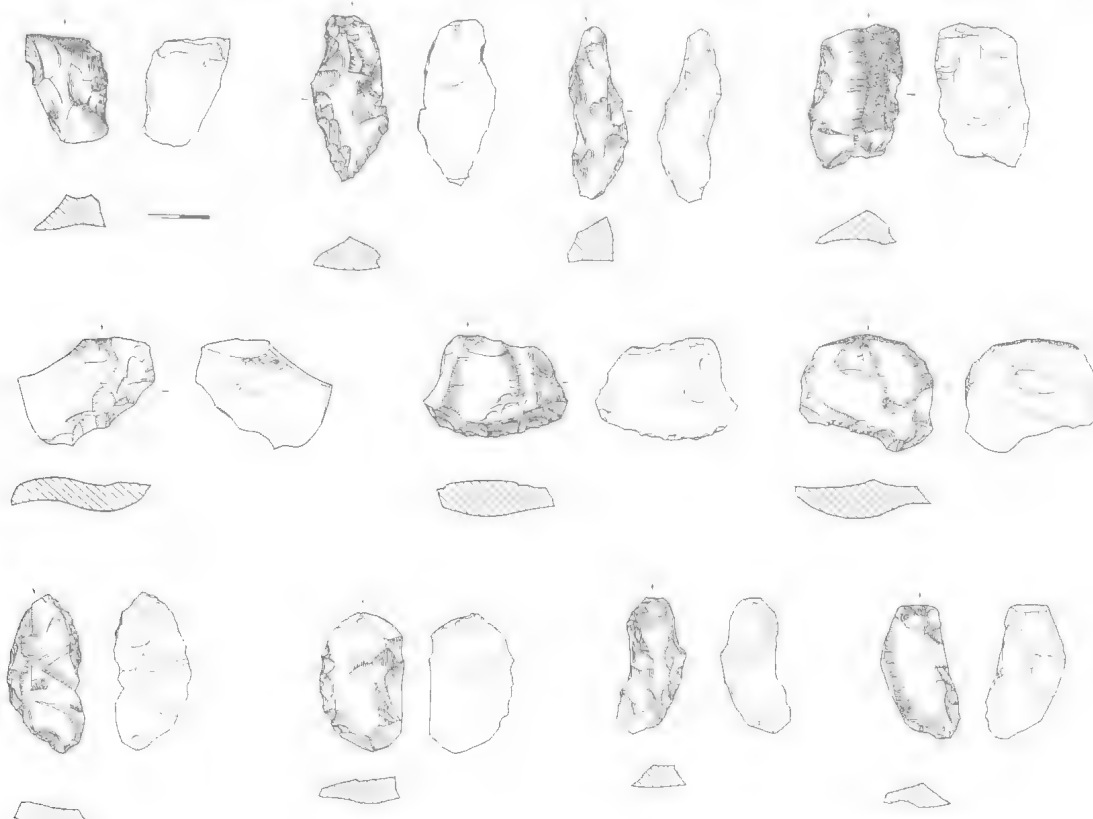


FIG. 27. Echidna's Rest: burren adzes and other modified flakes. Scale in cm units.

artefacts show twice as much edge modification (by length) as do SU2 artefacts;

4, in SU2 all edge angles are relatively acute (ranging from 8° to 60°), whereas SU1 has a broader range of angles;

5, heavy step fractures (often found on burren adzes) occur only in SU1.

Together, these points suggest that between c.3,000BP and 700BP, when SU2 was being formed, stone working, and by implication wood working, was not an important activity inside the dripline at Echidna's Rest. The last 700 years saw major increases in such activities.

The biggest change, however, took place after c.3,000BP. This is when the frequencies of all types of cultural materials increased the most. Mean edge lengths per artefact and per tool also increased significantly at this time, implying greater use of stone. The implications are that the last 3,000 years or so witnessed significantly greater intensities of site use at Echidna's Rest than during previous times.

DISCUSSION

Echidna's Rest appears to have been only very intermittently used until c.3,000 years ago, after which the intensity of occupation appears to have increased at an accelerating rate. Within this broad context, it is not until the last c.700 years that stone working and wood working activities became important, at least in those parts of the site that were excavated.

The single hearth excavated from SU2 is located near the centre of the main charcoal and ash concentration. The area around the hearth appears to have been kept clean of bone debris during SU1 times, as most bones are concentrated against the back wall during this time (see David, 1990a). The large cores on the surface of Echidna's Rest are preferentially located against the back wall (David, 1987). This is the case despite the fact that almost all other stone artefacts are found away from the wall, near and outside the drip line. These factors imply maintenance of the living space, which in turn probably signifies either prolonged use of the site, or an anticipated return after initial abandonment, or both (Stevenson, 1982).

WALKUNDER ARCH CAVE

Walkunder Arch Cave is located towards the southern end of the limestone belt. It is a large limestone cave located at the base of the Walkunder Tower. It contains a large, flat and

ashy floor exhibiting extensive evidence of human occupation. Some cave paintings and engravings are present on the walls, although they are not clustered in any single part of the cave. Campbell (1982, 1984) began excavations at Walkunder Arch Cave in the early 1980s, and although his excavations remain largely unpublished, enough material has been presented to allow an investigation of broad temporal trends.

Ten radiocarbon dates, spanning some 19,000 years were initially published (Campbell, 1982), followed by a longer list more recently (Campbell & Mardaga-Campbell, 1993). The stratigraphy is divided into two major units. The lower sediments are relatively homogeneous and compact, and contain relatively few cultural materials. This is followed by a series of finely stratified, ashy and charcoal-rich lenses with large amounts of cultural material. Campbell (1984: 178-179) argued that a sediment hiatus (absence of occupation?) separates the lower from the upper unit, in that '*at Walkunder Arch Cave the early Holocene is missing*' (Campbell, 1984: 178). This is evident '*between layers 8 and 7 [where] there is a major stratigraphic break which is clearly demonstrated by the difference between Beta-4326 and Beta-4327, both of which are on good charcoal samples*' (Campbell, 1982: 65). One of us has elsewhere argued that Layer 8 is probably a deflated deposit, and that two dates from Layer 8 and Layer 9 (Beta-4326 and Beta-4324) are inverted because of the disturbed nature of Layer 8 (David, 1983). Given the otherwise internally consistent sequence of dates, the major reversal of dates within Layer 8 cannot adequately be explained by a total absence of early Holocene sediments. The relatively coarser nature of sediments in Layer 8 is consistent with the notion that it is a deflated/lag or otherwise disturbed deposit, and that it should therefore be treated as a disturbed interface between cultural layers. Such a scenario also implies the presence of early Holocene deposits, rather than their total absence from the site. If this interpretation is to hold, we can expect further inversions of radiocarbon dates from Layer 8.

The distribution of cultural deposits follows the same general trends as those documented from other north Queensland sites. Charcoal, bone and stone artefact concentrations are particularly dense after $3,700 \pm 60$ BP (Beta-4327) (Campbell, 1982, 1984), coinciding with the appearance of the Small Tool Tradition (Campbell, 1982, 1984). Soon after $2,220 \pm 70$ BP (Beta-2478), a new stone industry appears. It is argued by Campbell

(1984: 179) to contain significantly smaller proportions of retouched tools (the Lesser Retouched Tradition). No details have yet appeared on either of these 'traditions' at Walkunder Arch Cave.

PILLAR CAVE

Pillar Cave is a large limestone cave (floor area = 150m²) located to the immediate southeast of Chillagoe. Excavations by Mardaga-Campbell (1986) began in 1985, specifically to study the occurrence of 'living floors' in the caves of the Chillagoe area. Consequently, a horizontal approach to excavation was adopted. Although her excavations have not been completed, with only the upper stratigraphic layers having been revealed, Mardaga-Campbell (1986: 51-55) has so far reported a sequence of finely stratified ash lenses and rich cultural deposits dating to 1,940±80 years BP (Beta-13230).

Research results from Pillar Cave remain largely unpublished. Little can thus be said about the cultural and depositional sequence at the site. Mardaga-Campbell noted, however, that although *'a minimum age estimate for the occupation sequence has presently not yet been obtained ... the lowest part of the profile at Pillar Cave resembles the most recent Pleistocene layer at Walkunder Arch Cave in the structure of the deposits themselves, and the appearance of large numbers of land snail shells. Unfortunately, the small amount of minute charcoal specks collected so far in the deepest part of deposits at Pillar Cave is insufficient for conventional dating. If a Pleistocene occupation were to be confirmed by radiocarbon dates, it would imply a very long hiatus between it and the late Holocene occupation which apparently began about 2000BP.'* (1986: 56).

DISCUSSION

Of the five sites excavated from the Rookwood-Mungana-Chillagoe limestone belt, only two detailed site reports have appeared (Echidna's Rest and Fern Cave). The conclusions generated from these studies are thus necessarily limited in scope. Nevertheless, some broad trends have emerged.

The post-3,700 year-old deposits from Walkunder Arch Cave are finely stratified, whereas the earlier sediments are more generalised. Large amounts of charcoal, stone artefacts, bone, and hearth debris are associated

with the upper layers, but not with the lower units. It has been argued elsewhere that the vast majority of the bone from the upper units is derived from human activity (David, 1983). Hence, although deposition rates have not been presented, increases in rates of disposal of food remains and stone artefacts after c.3,700BP are implied. It is not known whether deposition rates of other cultural items, such as ochre, also increased after that time. Associated with these changes are the beginnings of new stone tool types and possibly also of new technologies. The Small Tool Tradition (which remains undefined for the area) begins around 3,700BP at Walkunder Arch Cave, with further changes in stone artefacts taking place c.2,200BP (Campbell's Lesser Retouched Tradition). Foraging strategies focusing on the exploitation of non-juvenile rock wallabies were practiced from at least 3,700BP to present, although it is not known whether previous hunting strategies were comparable.

Thus there is evidence to suggest that the changes which took place at Walkunder Arch Cave c.3,700 years ago were systemic, in the sense that they involved alterations of various aspects of socio-cultural practice. Precisely what this pattern means is difficult to determine. Layer 8, immediately preceding 3,700BP, contains sediments showing evidence of reworking, erosion or deflation. It is thus difficult to determine whether the changes documented above really began to take place around 3,700 years ago, or whether they emerged sometime during Layer 8 (the early to mid Holocene). This question, therefore, cannot be resolved without further data.

The Echidna's Rest excavations have revealed temporal trends broadly comparable with those of Walkunder Arch Cave, although important differences also exist. The changes noted here include major increases in occupational intensities after c.3,000BP, followed by further increases after c.700BP. The only evidence for changes in formal stone artefact types occurred after c.700BP, when burren adzes first appeared.

The poorly differentiated nature of Echidna's Rest's deposits did not allow a fine temporal definition of stratigraphic units. Nevertheless, it was estimated that the rich cultural layers began around 3,000BP. It is difficult to know if this increase occurred in two stages (at c.3,000BP and c.700BP as indicated by the radiocarbon dates and stratigraphic changes), or if they were continuous after c.3,000BP. This uncertainty stems largely from the vagaries of poor stratification, as

the upper two units were shallow, and internal trends could not therefore be adequately investigated.

The Fern Cave results are intriguing, and introduce a new dimension to the research question — the problem of changing site use. We use the word 'problem' purposefully, because as archaeologists we tend to treat changes in terms of broad and relatively long-term events (e.g., the beginnings of new technologies or site types signifying social or cultural innovations). At Fern Cave, however, we have evidence of the same site being used over a considerable length of time — some 29,000 years — during which it is not so much the traits of the artefacts that change, as the nature of site use. During times of peak aridity (c.22,000-17,000BP), the site appears to have been used as some form of consumption and workshop base (perhaps as a residential base camp), as is implied by the numerous stone artefacts and bone remains discarded at that time. Sometime during the Holocene, however, the site's function changed significantly, with the appearance of large amounts of ochre accompanying a significant decrease in the discard of other types of cultural materials. The site thus appears to have been used extensively for the creation of painted and/or stencilled art from that time onwards, largely ceasing to be used as a residential base.

It is not possible to determine precisely when these changes took place because of the shallowness of the Holocene deposits and lack of appropriate radiocarbon dates. The timing of the cave's use as a residential base during a period of peak aridity, however, may be more than coincidental. Limestone caves of the Rookwood-Mungana-Chillagoe area in general, and Fern Cave in particular, are relatively humid places in an otherwise dry environment. Today, numerous drip spots accumulate water within the site throughout the year at Fern Cave, even though very little rain falls at Chillagoe for six months of the year. In this sense, the limestone zone is a refuge for biological organisms, including people.

The considerably drier nature of the region between 22,000 and 17,000BP may have encouraged use of the limestone zone. Peak occupation at Fern Cave during this time may be related to such factors. Permanent springs within 2km of Fern Cave, located in an otherwise dry landscape, adds further weight to its refuge status during this time. Subsequent increases in humidity after c.17,000BP may have encouraged further changes in site use, as the site's increased dampness

may not have been conducive to any form of prolonged occupation by people.

In short, the Rookwood-Mungana-Chillagoe limestone belt has revealed evidence for increased site use, together with increased deposition rates and changes in artefact typologies during the mid to late Holocene. In all cases except for Fern Cave, which possesses unusual environmental properties, the major changes took place during the late Holocene. It is difficult to determine precisely when these changes took place, but there is evidence to suggest that they were relatively sudden (punctuated), although maybe not exactly contemporaneous between sites. While some of these changes appear to be contemporaneous (e.g. increased deposition rates and the beginnings of the Small Tool Tradition around 3,700 years ago at Walkunder Arch Cave), others took place at different times. The relationship between these various changes remains unexplored, but will be further discussed below.

PRINCESS CHARLOTTE BAY AND THE FLINDERS ISLAND GROUP

Princess Charlotte Bay is located in the north-eastern corner of the study region. It is a large, crescentic bay whose northern boundary is ill-defined, but which can, for the sake of convenience, be taken to correspond with Claremont Point (Fig. 28). To the east, a low, dissected sandstone plateau (300-400m ASL), known as the Bathurst Range, stands in marked contrast to the bay proper. An insular extension of the Range appears in the form of the Flinders Island group, northeast of the bay. Located between three and twenty-one kilometres off-shore, the major islands — Clack, Stanley, Flinders, Blackwood and Denham — contain an abundance of sandstone rockshelters, although few possess any surface cultural deposits.

Princess Charlotte Bay is drained by three major river systems, the Normanby, Kennedy and Stewart rivers. A broad range of environmental zones occurs around the bay, although flat, sandy plains are predominant. Swamps are abundant, while mangrove forests fringe the bay's inshore margins and the lower reaches of the rivers. Supratidal saline silt flats separate the marine environment from the Bathurst Range. It is on the former that numerous cheniers have accumulated, many of which contain large and mounded

shell middens (Beaton, 1985; Chappell, 1982; Chappell et al., 1983).

THE ARCHAEOLOGICAL SITES

Beaton (n.d., 1981, 1985) undertook a series of archaeological excavations at Princess Charlotte Bay and on the Flinders Island group. The main aims of his research were to determine:

- 1, the length of occupation of the area, and
- 2, the area's economic (especially subsistence) base (Beaton, 1985).

Each of these questions focused on investigating the antiquity of coastal occupation (including the use of cheniers) at Princess Charlotte Bay and surrounding areas (Beaton, 1985: 5). Beaton (1985) obtained radiocarbon determinations from three rockshelters and seven mounded shell middens. Few of the results have yet been published, but what has been reported to date is sufficient to make general statements about broad regional trends.

ENDAEN ROCKSHELTER

Endaen Rockshelter is a large sandstone overhang located on Stanley Island. A single, 1m x 2m pit was excavated in 10cm arbitrary spits in 1979, and the site was poorly stratified. Beaton (n.d.: 9) wrote that '... the entire deposit reflects a Holocene maritime economy', noting that spit 1 (1-10cm below surface) was dominated by the mangrove gastropod, *Terebralia palustris*. It made up 40% by weight of the 21 species identified from this level, with *Lambis lambis*, a reef gastropod, contributing 20% (Beaton, 1985). Spits 2-4 showed a similar distribution of shellfish species, with the addition of two or three wallabies (wallabies do not occur on the island today). No stone artefacts were found, although *Geloina* scrapers occurred throughout the sequence. Mangrove and reef shellfish, dugong and turtle were present in low numbers, and fish remains were rare. Below the shell midden material a thick, sterile sand and rubble layer was identified. A radiocarbon date of $2,370 \pm 100$ BP (ANU-3379) was obtained from near the base of the cultural layers. Beaton thus concluded that '... marine oriented people with boats began to occupy it about 2500 years ago. Since that time, there has been no significant change in the economic base as estimated by the kind and number of shellfish species collected.' (1985: 6).

Whether the Endaen Rockshelter subsistence base changed or not during the course of its occupation is difficult to assess, given the thick-

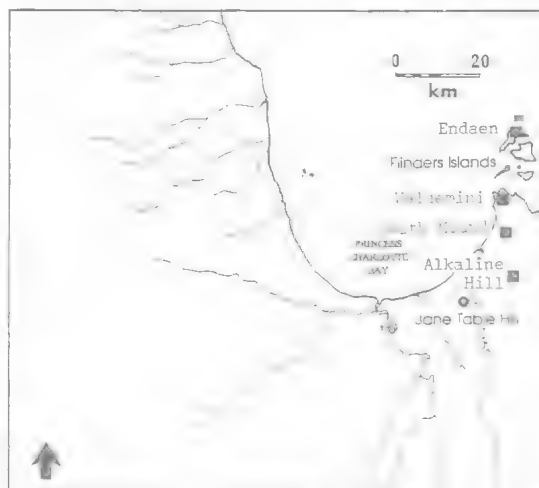


FIG. 28. Princess Charlotte Bay and the Flinders Island group, showing locations of excavated sites.

ness of the excavation units used and the lack of clean stratification of the deposits. It is difficult to know if the minor variations which Beaton (1985, n.d.) identified between the excavated spits represent significant changes of short duration, important broader trends, or whether they are insignificant variations in a generalised maritime economy spanning the duration of occupation at the site. The employment of coarse-grained, 10cm spits within a single 2m² excavation pit has resulted in producing a generalisation of trends within each spit. It is also uncertain whether or not the paucity of fish recovered is a result of the processing of excavated sediments through a relatively large, 1/8" mesh (3.2mm) sieve (Frankland, 1990). Nevertheless, the timing for the initial occupation of the site to some 2500BP is probably a reliable estimate, although only a single date was obtained.

WALAEMINI ROCKSHELTER

Walaemini Rockshelter is a small overhang located in a sandstone outcrop near the northern tip of the Bathurst Range. Its maximum height would once have been 2m from floor to ceiling, but this has shrunk to 1.5m with the accumulation of midden deposit in the site. The deposit contains compact shell midden material over at least 20cm of archaeologically sterile sandy roof-fall sediments. Initial occupation at the site is dated to 4,700BP (Beaton, 1985).

The excavation methods and the number of spits excavated from the site have not yet been reported, but the following information enabled Beaton (1985) to construct a basic temporal

framework for habitation at Walaemini Rockshelter. Beaton (1985: 7) reported that *Anadara granosa* contributed 60% by weight of spit 8, and the two lowest spits contained seven species of shell. The lowest levels contained 6% *Ostrea* sp., compared with 22-28% in the upper levels. In contrast, up to nine shellfish species were recovered from the middle and upper spits, leading him to conclude that this 'may reflect an increasing understanding by Aborigines of species patterning and availability on the mud flats and rocky foreshore, or may be due to increased species abundance in the maturing mudflat shellfish community'. Mud flat, mangrove and a single rock shore species accounted for all of the shellfish represented at the site. Some fragments of macropod, bird and fish bone were recovered, but these were rare. *Geloina* shell tools occurred in all but the basal spit.

It is difficult to adequately assess Beaton's conclusions quoted above, given that a detailed site report has not yet appeared, and that all we have before us is that new shellfish species appear 'in the middle and upper levels' (Beaton, 1985: 7). Are they rare species which are accompanied by an increase in the rate of deposition of the dominant species, *Anadara granosa*? Are they numerically important? Is the time-span covered by the middle and upper spits comparable with that from the lower spits? If not, an increase in shell species in the middle and upper spits (and an increase in numbers of the dominant species?) may mean only that the middle and upper spits cover a longer period of time, and that therefore they do not reflect real increases in shell deposition rates. Together, these uncertainties make it difficult to assess the types of conclusions made by Beaton (1985) and quoted above. The single, basal date precludes us from further discussing these issues.

ALKALINE HILL

Alkaline Hill is a sandstone rockshelter located at the base of a sandstone cliff to the west of the Bathurst Range, near the edge of a chenier plain. A single 1m x 2m pit was excavated in 1980 by Beaton (1981, 1985) in 10cm spits, but the excavation results remain unpublished. We are nevertheless told that the excavated sediments contained two depositional horizons, differentiated by variations in the colour of the sediments, and by differences in the frequencies of mangrove species (Beaton, 1985). As with other sites in the region, *Anadara granosa* dominates

the midden refuse, with macropod bones occurring sporadically. No stone artefacts were found, but *Geloina* scrapers occurred throughout the sediments. A radiocarbon date of $3,440 \pm 80$ BP (ANU-3041) was obtained from the base of the occupational deposits, overlaying 2.5m of sterile sand and rubble. As with the other excavated sequences from the area, the Alkaline Hill excavations revealed evidence of a specialised marine economy from the onset of occupation (Beaton, 1985).

THE SOUTH MOUND

Although seven mounds are reported to have been dated by Beaton from Princess Charlotte Bay and the Flinders Island group, only one set of dates — from the South Mound — has been published (Beaton, 1985; see also Beaton, 1981: 13). The site is a large mound located on a chenier ridge immediately to the west of Bathurst Range.

The South Mound was partially excavated in 1979-1980 (Beaton, 1985). Its stratigraphy was revealed by a backhoe trench, from which a 1m x 1m test pit was excavated in 12 stratigraphic units (Beaton, 1981, 1985). Twenty three species of shellfish were identified from the deposits, with more than 96% (by weight and by MNI) consisting of *Anadara granosa*. Rare fish and turtle bones were also found throughout the deposits. Beaton (1985: 7) could find no evidence that any structure was ever built on the mound, or that living floors were prepared or maintained, but this is not surprising given the nature of the excavation. Beaton (1985) also obtained a long sequence of radiocarbon dates, concluding that the mound formed rapidly via the deposition of predominantly *Anadara granosa* lenses. A near-basal date of $1,715 \pm 55$ (Beta-1754) dates the beginning of occupation at the site.

The mound is stratified in the sense that sediment-rich lenses alternate with lenses with little sediment. The former are darker than the latter, and contain more aeolian silts, although shell remains are still dominant. Beaton (1985: 7-8) interpreted the mound's formation as resulting from a series of occupational events (represented principally by the sediment-poor lenses) interspersed with periods of site abandonment when vegetation growth occurred on the mound (sediment-rich lenses). He summarised the results obtained from the South Mound and other middens from the area as follows: 'Three C14 dates for basal horizons of shellmounds distributed on the chenier system suggest that earliest dates for the shellmounds will not much exceed 1700-1500BP

... Seven other dates from basal horizons of other shellmounds also on the cheniers suggest that the period around 1200-800 years BP saw the production of more numerous (and larger) mounds. Five dates from the surfaces of shellmounds on all cheniers are all ca. 500-400 years BP, which I take to be the approximate period when large scale *Anadara* deposition ceased.' (Beaton 1985: 8-9).

These findings are particularly important given that cheniers have been in existence for at least 4000 years. The following should be recalled of the overall chenier plain history at Princess Charlotte Bay:

- 1, chenier formation began c.4,000 years ago.
- 2, occupation of the cheniers commenced c.2,000-1,700BP.
- 3, the occupation deposits were most numerous and largest in the period around 1,000BP.
- 4, By 500-600BP large cheniers were no longer forming and the large scale exploitation of *A. granosa* had ceased.

Together, these findings suggest that important changes have taken place throughout the late Holocene in Princess Charlotte Bay and the Flinders Island group.

DISCUSSION

Although the excavation techniques used at Princess Charlotte Bay and on Stanley Island may not have been ideal (especially in respect to the use of coarse, 10cm spits), some general temporal trends have nevertheless emerged. The first, and most obvious, is a general lack of any evidence for human occupation before 4,700BP. What this means remains uncertain, but it at least suggests that earlier evidence for occupation in the area has not been as forthcoming as for late Holocene times. Beaton (1985) believes that this implies a time-lag between the stabilisation of sea levels at their current position perhaps 6,000BP, and the beginnings of systematic coastal occupation in the region some 2,000 years later. It remains to be seen, however, whether or not enough data has been presented to warrant such a conclusion (see Barker [1995] for detailed criticisms of this model; see also O'Connor [1992]). One clear pattern of coastal occupation nevertheless remains: in spite of the presence of cheniers during the past 4,000 years at least, it is not until approximately 2,000BP (and possibly slightly later than this) that mounded middens began to be built on the chenier plains. Furthermore, their

numbers peaked from 1,200 to 800BP, and may have ceased approximately 500BP.

Mound construction at Princess Charlotte Bay is related to the systematic exploitation of the mangrove species, *Anadara granosa*, and to the establishment of associated consumption bases. As such, mound construction may imply the beginnings of new resource exploitation strategies, as well as changes in settlement systems. Together, this implies an alteration in resource management strategies sometime after 2,000-1,700BP, although more data are needed now to define this event accurately. The excavations at Walaemini, Alkaline Hill and Endaen rockshelters clearly indicate that subsistence strategies targetting mangrove resources, and especially *A. granosa* beds, have an antiquity pre-dating mound construction. Although this offers us historical precedents by which to better understand the origins of subsistence-settlement strategies involving mound construction, the archaeological data presented so far unfortunately do not allow us to progress much further with such enquiries.

THE KOOLBURRA PLATEAU

Eighty kilometres south of the sub-coastal fans and alluvial plains surrounding Princess Charlotte Bay is a major, crescentic belt of Cretaceous and Jurassic sandstones commonly referred to as 'Quinkan Country' (Trezise, 1969). It extends from northwest of Cape Flattery, arching its way inland via Laura, and terminates shortly to the west of the Koolburra Plateau. At its highest levels, the sandstone plateau reaches an elevation of 1700m ASL, although in many places it is considerably lower in height. Towards its western reaches it attains a maximum elevation of almost 300m ASL (de Keyser & Lucas, 1968; Flood & Horsfall, 1986). The area is deeply dissected by a number of rivers, the main ones being the Kennedy, Laura and Normanby (Fig. 29).

The Koolburra Plateau constitutes the western end of the Laura sandstone belt. It is separated from the latter by the Kennedy River, which acts as a convenient geographical marker that, for analytical purposes, allows us to treat the Koolburra Plateau as a relatively distinct and discrete geographical unit. The Laura sandstones proper will be discussed separately below.

Flood (1987; Flood & Horsfall, 1986) undertook detailed archaeological investigations in the Koolburra Plateau during Earthwatch-sponsored

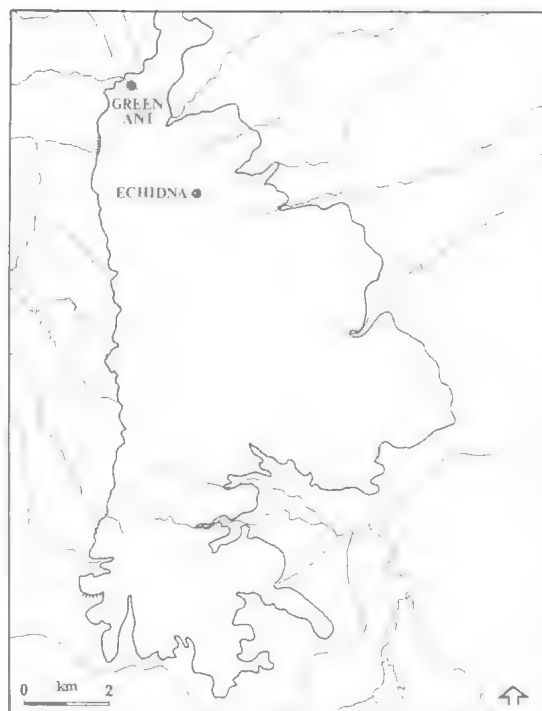


FIG. 29. The Koolburra Plateau, showing locations of excavated sites.

fieldwork in 1981-2. The aims of her research focused on the excavation of a small number of cultural sequences 'in order to establish an age bracket for the art, to reach a fuller understanding of the prehistoric culture and technology of the region and of changes over time and space, and to make comparisons with the cultural systems of adjacent regions' (Flood & Horsfall, 1986: 12).

A particular focus on rock art sites, and a selection of sites with both paintings and patinated engravings and apparent deep sequences, were explicit and central components to Flood's research. Consequently two sites — Green Ant and Echidna shelters — were excavated by Flood & Horsfall (1986), each of which met the above criteria. Excavations in both cases were undertaken in 5cm arbitrary spits following the site's stratigraphy. A 2mm-mesh sieve was employed. It is to be noted that the vast majority of sites recorded contained either a total lack of cultural deposits, or evidence for the presence of shallow deposits only (Flood, 1987; pers. comm., 1990).

THE ARCHAEOLOGICAL SITES

GREEN ANT ROCKSHELTER

Green Ant is a medium-sized (12m x 3.5m) sandstone rockshelter located near the base of the northern extremity of the Koolburra Plateau. It was rediscovered by Percy Trezise in 1978, and seven 50cm x 50cm squares were excavated in 1981-2. Distinct stratigraphic units were not discerned, as the sediment matrix was relatively homogeneous throughout the deposits. An internally coherent sequence of nine radiocarbon determinations, dating to $8,660 \pm 340\text{BP}$ (ARL-151), revealed a near-complete Holocene sequence consisting of what Flood & Horsfall (1986) characterised as a two-phase cultural sequence.

Cultural Materials: Deposition Rates and Stone Artefact Types. We have estimated deposition rates of cultural materials and sediments for Square 018 using the depth-age curve method. All of the radiocarbon dates reported by Flood and Horsfall (1986) for Square 018 were used to construct the depth-age curve. The curve was constructed by linking the individual dates, although a midpoint was used between samples ARL-224 and ARL-150 because of a slight reversal in radiocarbon dates (Fig. 30). The age of each spit of Square 018 was then interpolated from this curve (Table 22).

A series of changes can be identified from the deposition rates. Following initial occupation slightly before 8,500 years ago, deposition rates of all cultural materials are initially low, followed by a major increase c.8,200 years ago. This is followed by a marked decrease in deposition rates of sediments and, to a lesser degree, cultural materials after around 7,100BP¹. The latter are associated with a change from rubble (Layers 5-7) to sandy layers (1-4), probably indicative of the onset of wet climatic conditions in north Queensland during the early Holocene, initiating extensive exfoliation of the cave wall, colluvial slope wash, and washing away finer sediments (David, 1987; Flood & Horsfall, 1986; Hughes, 1977). A major break in deposition, or, more likely, an erosional stage, may be indicated by an apparent temporal discontinuity between spits 16 and 15. This is implicated by a 3,000-year gap in radiocarbon dates between these two spits, from $7,550 \pm 250$ (spit 16) to $4,350 \pm 190$ (spit 15). This depositional hiatus may be due to some climatic factor (presence of a lag deposit?), although this

¹ Note that an editorial error resulted in the publication of Echidna Shelter data for the Green Ant excavations (Flood & Horsfall, 1986: table 3). The correct Green Ant data, which were originally submitted as their table 3, was obtained from Flood (pers. comm., 1990).

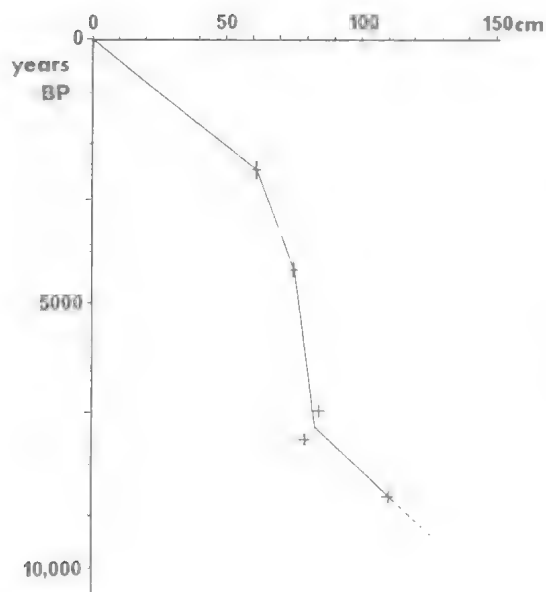


FIG. 30. Green Ant Rockshelter: depth-age curve for Square 018 (after Flood & Horsfall, 1986). X axis = cm below ground surface.

possibility requires further geomorphological investigation.

It is not until approximately 2,200-1,800BP that the deposition rates of both sediments and cultural materials begin to increase again, gaining momentum through the course of the late Holocene (Table 23, Fig. 31). The extent to which renewed decreases in rainfall (and also decreases in natural alterations in cave wall exfoliation and sedimentation processes) some 3,000BP affected these changes is uncertain. However, the lack of synchronicity between, on the one hand, climatic changes (3,000BP) and, on the other, changes in sedimentation and cultural deposition rates (2,200-1,800BP) indicates that the latter cannot be explained simply by the former. Flood & Horsfall (1986) also note that a broadening of the tool kit (stone artefact types) takes place c.1,400BP, indicating that the observed changes cannot be taken to directly reflect the major climatic changes that occurred c.3,000BP.

To Flood & Horsfall (1986: 57), the association of increased sedimentation and artefact discard rates during the late Holocene implied an 'increased intensity of site use about 2500BP', noting that 'there is no sign of any diminution in intensity of site usage in the most recent levels'. Contemporaneous increases in ochre deposition rates may have heralded a 'flowering of the ...

stencil and painting art' (Flood, 1987: 117), a point to which we shall return. It is not until 1,400-1,200BP, however, that qualitative changes in stone tools begin to appear in the form of burren adzes (Flood & Horsfall's [1986: 33-34] flake scrapers), indicating the multi-dimensional nature of change during the late Holocene in the Koolburra Plateau. Apart for two hammerstones, burren adzes were the only recognised artefact types excavated from Green Ant Rockshelter.

ECHIDNA SHELTER

Echidna Shelter consists of a massive overhang formed under a split sandstone boulder located 3km southeast of Green Ant. It contains numerous rock paintings, stencils and weathered engravings. It is the latter's apparent great antiquity which led Flood & Horsfall (1986) to excavate the site in 1981. As they noted: '... the high degree of weathering of the engravings on the back wall of the shelter suggested that they might be of considerable antiquity. It also seemed possible, although less likely than at Green Ant Shelter, that they continued below the present ground surface' (Flood & Horsfall, 1986: 40).

Three 1m x 1m squares were excavated, revealing five major stratigraphic units containing cultural materials dating from slightly below a date of $7,280 \pm 130$ BP (ARL-155) to ethnohistoric present. Coarse sediments and relatively high sedimentation rates were evident during early to mid Holocene times, probably reflecting climatic influences similar to those documented from Green Ant. Ochre fragments were recovered throughout the post-5,970 \pm 400BP period.

Stone Artefacts. Flood & Horsfall noted: '... artefact types are generally similar to those at Green Ant Shelter, with the same hafted wood-scrapers in use from about 6000BP to the most recent horizon. More specialised small tools appear in the sequence after 3000BP—a thumbnail scraper from between about 1500 and 2500BP and a geometric microlith between about 2500 and 3000BP.' (1986: 54).

The numbers of such types are so rare, however, that the significance of their late appearance in the sequence remains uncertain, especially given their total absence from the excavated deposits at Green Ant. The last millenium witnessed a significant shift in the dominant use of raw materials from quartzite to chert (Flood & Horsfall, 1986: 47-48).

Deposition Rates. Deposition rates were calculated via reference to the depth-age curve (Fig. 32). The interpolated age of each spit of Square

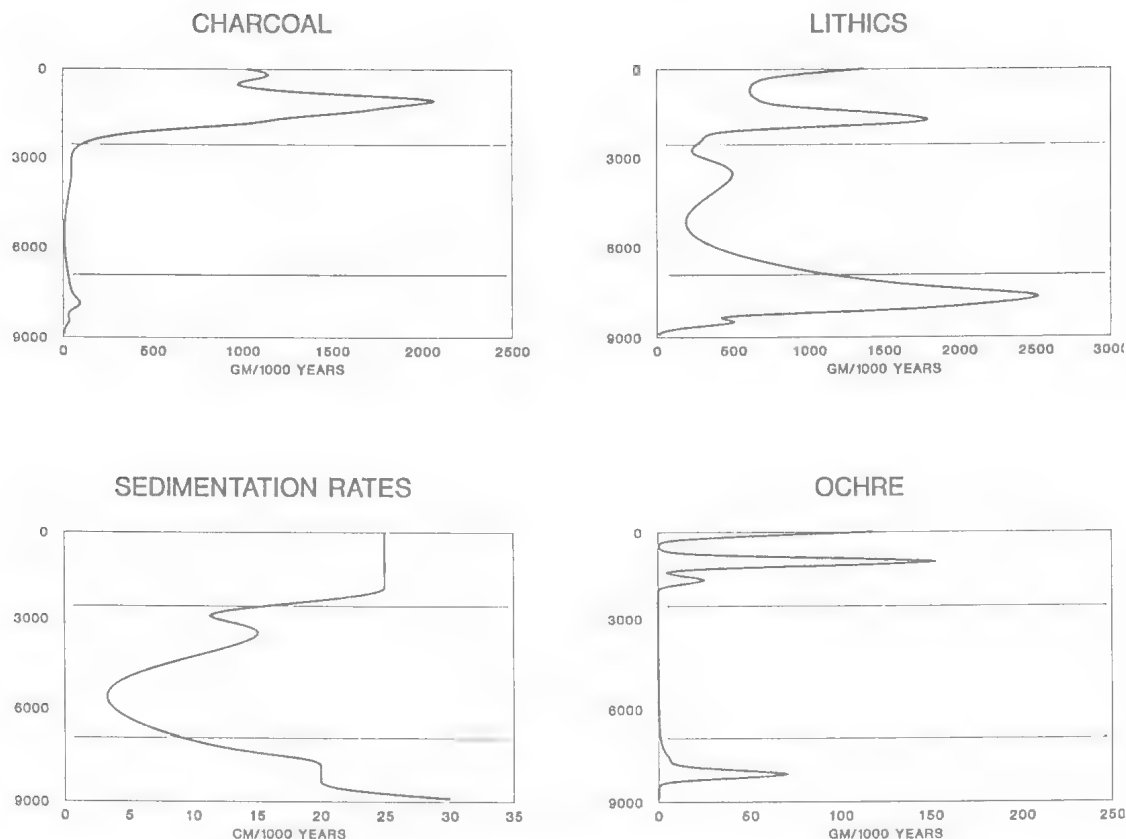


FIG. 31. Green Ant Rockshelter : deposition rates (per m²/1000 years) for Square 018.

L24 is presented in Table 24. All of the radiocarbon dates presented by Flood & Horsfall (1986: Table 9) were used to construct the depth-age curve. Table 25 lists the discard rates for various cultural materials. The only significant trend is an increase in discard rates (especially of stone artefacts) after 1,400BP.

DISCUSSION

The overall pattern of change indicated by the Koolburra Plateau excavations implies that dynamic climatic conditions during the course of the Holocene resulted in radical alterations of sedimentation regimes during the mid Holocene. Within this context, two periods of peak deposition rates can be identified at Green Ant (8,150-7,100BP, and post-2,000BP). Whether or not low deposition rates between 7,100 and 2,000BP are due to changes in environmental conditions (and to an erosion of materials from the site) remains uncertain (and largely uninvestigated). Nevertheless, it is not until at least 1,000 years after

stabilisation of environmental conditions some 3,000 years ago that major changes in the cultural record become apparent (around 2,000BP). These include increased deposition rates of stone artefacts, ochre, charcoal and fine, ashy sediments approximately 2,200-1,800BP at Green Ant, with similar increases in artefact discard rates taking place around 1,400BP at Echidna Shelter. The timing of the documented changes is neither synchronous within sites nor between them. Hence at Green Ant a new artefact type (the burren adze) makes its appearance 1,400 years ago, some 1,100 years after the initiation of significant increases in deposition rates. It is not until the last 1,000 years that the relative importance of raw materials (especially quartzite and chert) are significantly altered.

The implications of these patterns are multiple. First, in spite of the limited data base, the late Holocene, and especially the last 2,200-1,800 years, appears to be a period of major cultural change. Increased ochre deposition rates probably imply significant increases in cave painting

and/or stencilling activity, a claim compatible with findings reported by others from various parts of Queensland (e.g. Morwood, 1979). Increased deposition and sedimentation rates during relatively recent times may further indicate increases in occupational intensities within both Echidna Shelter and Green Ant during the last two millennia. Yet, in direct contradiction with these findings, Flood & Horsfall concluded that: *'... one of the surprising features of the Koolburra sites is the apparent lack of change in their assemblages over an 8000 year time span. In both sequences there is a remarkable stability and continuity, with no basic change in the size, material or morphology of artefacts over a time span of more than seven millennia.'* (1986: 54-56).

This conclusion is surprising, especially given that they fully acknowledged that major changes in sedimentation and deposition rates, and in stone artefact types, took place during the late Holocene. This is clearly demonstrated by comments such as *'... there is an increase in both artefact discard and sedimentation rate at Green Ant Shelter at about 2550BP'*, *'increased intensity of site use about 2500BP'*, and *'changes which may reflect intensification are discernible at ... Green Ant ...'* (Flood & Horsfall, 1986: 57-58).

Research strategies in the Koolburra Plateau have been aimed at excavating sites with the deepest and oldest apparent sequences, biasing results towards the recovery of old deposits. The large numbers of rockshelters with apparent shallow occupational deposits recorded by Flood & Horsfall (1986) are likely to mainly date to relatively recent (late Holocene) occupation (the findings at Ngarabullgan Cave notwithstanding), further accentuating the point that significant changes in occupational strategies took place during the late Holocene throughout the Koolburra Plateau. These changes are most readily explained in terms of increased occupational intensities within individual sites and of the Koolburra Plateau more generally, although as we shall see later, they may alternatively — or additionally — be interpreted as indicative of structural changes in existing systems of land use.

The second important implication of the Koolburra findings concerns chronostratigraphic problems making it difficult to determine precisely when the documented changes took place. For example, changes which Flood & Horsfall (1986) estimate as taking place around 2,500BP are here dated to sometime between 2,200 and 1,800BP via reference to the depth-age

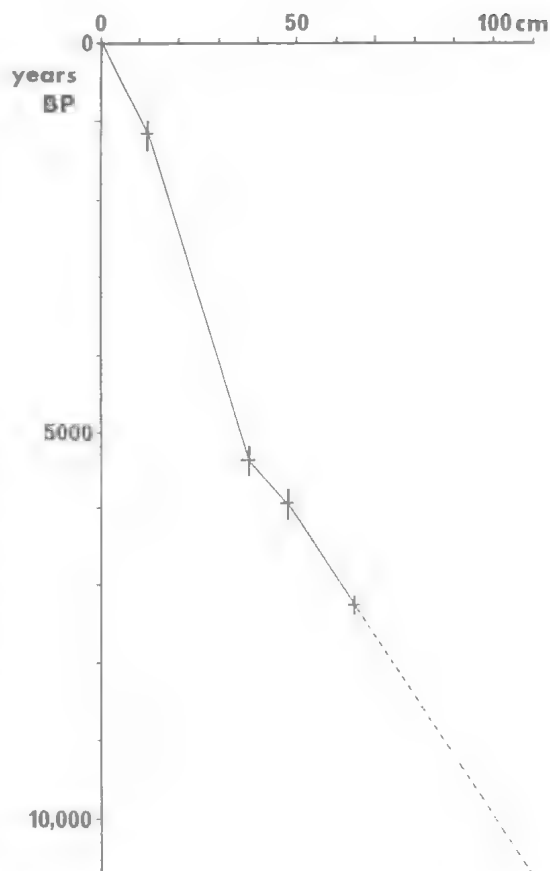


FIG. 32. Echidna Shelter: Depth-age curve for Square L24 (after Flood & Horsfall, 1986).

curve (Flood & Horsfall, 1986: figure 6). This problem of timing has already been observed from other subregions (e.g. the Mitchell-Palmer limestone belt), and will re-appear elsewhere in this monograph. The problem of timing is due to a combination of factors, including the poorly stratified nature of excavated deposits, and the coarseness of the excavation methods used. Clearly, if temporal issues are to be discussed, excavation techniques need to be refined to enable the establishment of relatively fine grained chronological bases upon which our broader investigations can be built.

The above comment notwithstanding, the third major implication of the Koolburra results relates to the apparent non-synchronicity of changes both within and between sites. As we have seen, within each site a number of changes relating to various aspects of socio-cultural life — e.g. artefact technology, artistic endeavours and occupational intensities — occurred at different points during the

late Holocene. At Green Ant such changes take place at various times between 2,200-1,800BP and 1,400BP, while at Echidna Shelter they occur at various times between 1,400 and 1,000BP. These observations are critical to a proper understanding of the dynamics of change throughout the region and beyond, and critical also to an adequate characterisation of these changes for the Koolburra Plateau. Any model purporting to address the nature of change during the late Holocene — whether it attempts to explain the observed changes via reference to taphonomic processes, processes of socio-cultural dynamics, or as an artefact of the methodologies employed by researchers — needs to be capable of accounting for these issues.

LAURA AND BARE HILL

Immediately east of the Koolburra Plateau, across the Kennedy River, the dissected sandstone plateau increases in height, reaching its highest point along its southern and eastern reaches (Flood & Horsfall, 1986: 6; Rosenfeld et al., 1981: 46). This is the area of the Laura sandstones, commonly referred to as Quinkan Country after the Aboriginal spirits who shelter there (Trezise, 1969). The sandstone plateau is dissected by numerous rivers and creeks, forming gorges and sandstone cliffs, many of which contain rockshelters. It is amongst these shelters that archaeological investigations have concentrated (Figs 33, 34).

THE ARCHAEOLOGICAL SITES

MUSHROOM ROCK

Mushroom Rock, originally referred to as the L-1 shelter by Wright (1971), is a rockshelter formed by an isolated, mushroom-shaped sandstone rock some 3km southeast of Laura. It was excavated by Wright (1971) in 1964, where he obtained a poorly stratified, 6m deep sequence. Although the excavation remains largely unpublished, dates of $1,830 \pm 110$ BP (1-1736) at 75cm below the ground, and $6,870 \pm 150$ BP (laboratory number unknown) at a depth of 2m have been obtained, indicating that occupation may have begun sometime during the late Pleistocene or early Holocene (Wright, 1971: 139). The timing of the only significant changes in the stone artefact content reported were estimated by Wright (1971) to date to c.3,000BP, and included the first appearance of blades, burren adzes and

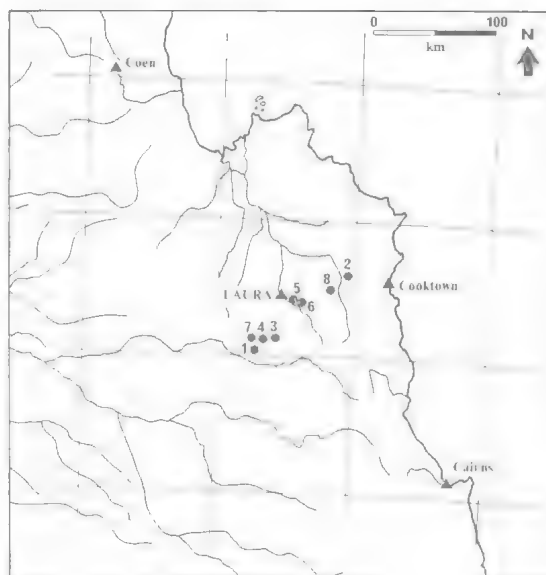


FIG. 33. The Laura sandstone belt, showing the location of sites mentioned in the text. 1 = Yam Camp; 2 = Platform Gallery; 3 = Magnificent Gallery; 4 = Sandy Creek; 5 = Mushroom Rock; 6 = Early Man; 7 = Red Bluff; 8 = Red Horse.

cloueras in the deposits. Around this time also, at above 1.2m below the ground surface, mean artefact weights begin to decrease. A major problem exists here, however, as the only data reported are presented in three depth units — surface-1.2m, 1.2m-2.1m and 2.1m-3.4m below the ground surface. Because of this, it is not possible to indicate just when the observed changes began. Unfortunately, no further details about the distribution of cultural materials have been reported, although we are told that ochre is present throughout the sequence (but not whether or not densities change through time). The lack of published information and a paucity of radiocarbon dates prevents the calculation of deposition rates to enable these questions to be addressed. Morwood (University of New England, pers. comm., 1994) is currently examining Wright's excavated materials, and has recently re-excavated at Mushroom Rock. This hopefully will enable a fuller characterisation of temporal trends at the site to be assessed.

EARLY MAN ROCKSHELTER

The Early Man Rockshelter was rediscovered by Trezise (1973) in 1972, approximately 15km east of Laura. The numerous patinated engravings at the site, and their continuation below the shelter floor, led Trezise (quoted in Rosenfeld et

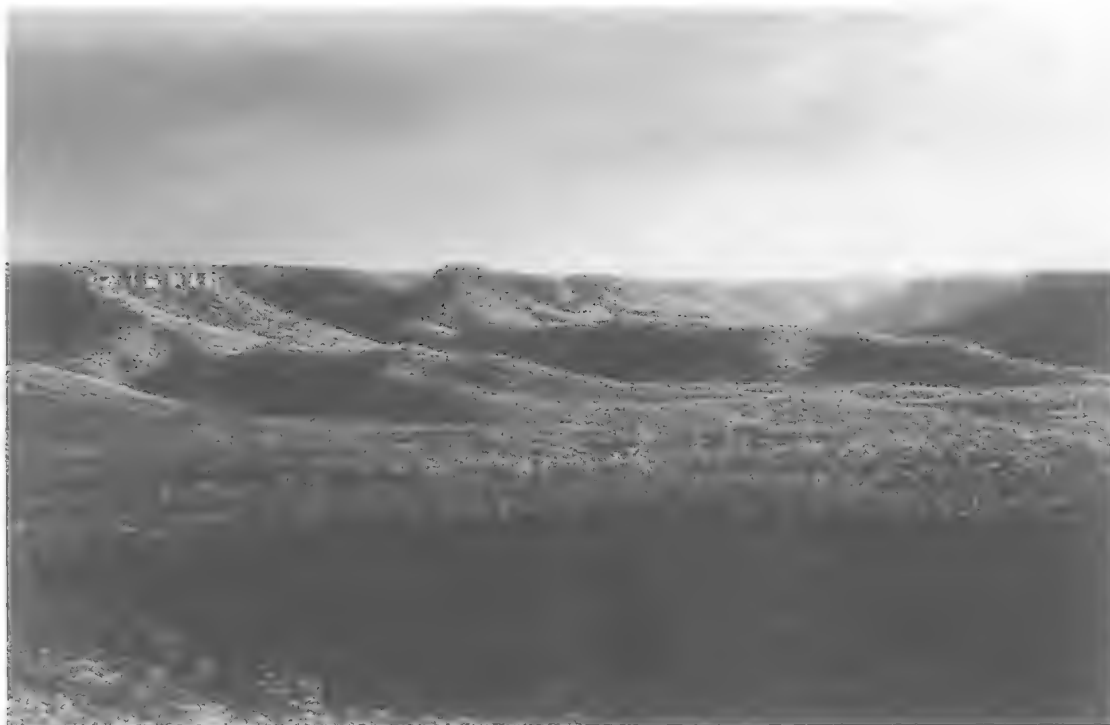


FIG. 34. Laura's dissected sandstone plateau (photograph courtesy of the Cultural Heritage Section, Queensland Department of Environment and Heritage, Brisbane).

al., 1981: 1) to believe that the site had considerable antiquity, encouraging Rosenfeld (1975, Rosenfeld et al., 1981) to excavate it in 1974. As Rosenfeld et al. (1981) noted, the reasons for excavating it were directly related to the potential that this site promised for investigating the antiquity of rock art from the region: *'Because of the association of painting, rock pecking and artifacts at the Early Man Shelter, as well as its location and morphology, it appeared a promising site in which to test the relative antiquity of the art styles and to explore their respective archaeological associations'* (Rosenfeld et al. 1981: 5).

Early Man Rockshelter consists of a large overhang under a massive sandstone block which is located on the side of a hill, below the escarpment of a small tributary of the Laura River. Approximately 80m² of deposit are located on a relatively flat floor, some 40% of which lie underneath the overhang (after Rosenfeld et al., 1981: fig. 2). Fourteen 1m x 1m squares were excavated (approximately 20% of the deposits), three of which were located against the back wall in order to obtain minimum dates for the subsurface engravings. Eight stratigraphic layers were identified, all of which consisted of uncon-

solidated sands differentiated largely by changes in compaction and by variations in the degrees to which the deposits were charcoal-stained (Rosenfeld et al., 1981:7). Twelve radiocarbon dates were obtained, including a near-basal date of 18,200±450BP (ANU-1565) in sterile sand (Rosenfeld et al., 1981:12-13). Dates of 13,200±170BP (ANU-1441) and 15,450 ±500BP (ANU-1567) were obtained from sediments covering patinated peckings, giving them a minimal age (Rosenfeld et al., 1981).

Sedimentation at the Early Man site was not uniform through time, with a major transition from *'stony to stoneless deposit ... dated to about 3000BP'* (Rosenfeld et al., 1981: 13). This stratigraphic change has been interpreted by Rosenfeld et al. (1981: 13-14) as a result of changes in climatic regimes similar to those outlined by Kershaw (e.g. 1975a) and others (e.g. David & Stanisic, 1991) from nearby areas. Rosenfeld et al. (1981: 13) argued that *'... a curve drawn through the age determinations ... shows that the overall rates of sedimentation have not varied significantly since first occupation of the shelter which is dated ... [to 11,850±210BP] ... taken from artifact-bearing deposits ... The change in*

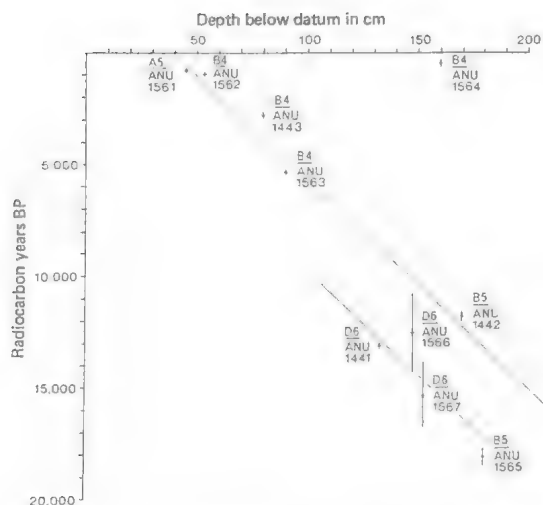


FIG. 35. Rosenfeld et al.'s (1981: fig. 4) depth-age curve.

slope between this point and the stratigraphically lower ANU-1565 in clean, sterile, compacted sand indicates slower rates of sediment accumulation prior to this'. In short, Rosenfeld et al. (1981) have argued that the earliest, pre-occupation levels at the site are characterised by slower sedimentation rates than those of later, occupied times.

Investigating Deposition Rates. In spite of Rosenfeld et al.'s assertion that '... overall rates of sedimentation have not varied significantly since first occupation of the shelter', their depth-age curve (Rosenfeld et al., 1981: fig. 4) shows quite the opposite trend. The problem stems largely from their calculation of sedimentation rates by superimposing a linear regression line through all acceptable radiocarbon dates obtained from Squares A5, B4 and B5 (Fig. 35). If each individual date is linked, however, a different trend emerges (Fig. 36). In agreement with Rosenfeld et al., sedimentation rates are lowest during the earliest (pre-occupation) times, and continue to be relatively low during most of the occupational sequence. Sometime after $2,850 \pm 80$ BP (ANU-1443), however, they begin to accelerate, so that by at least 950 ± 70 BP (ANU-1562), sedimentation rates have more than doubled. Higher rates continued until recent times. The commencement of high sedimentation rates at the Early Man site is thus dated to sometime between approximately 3,000 and 1,000BP (Tables 26-27, Fig. 37).

The Early Man material is problematic in that radiocarbon dates were obtained from spatially dispersed parts of the site (a common ar-

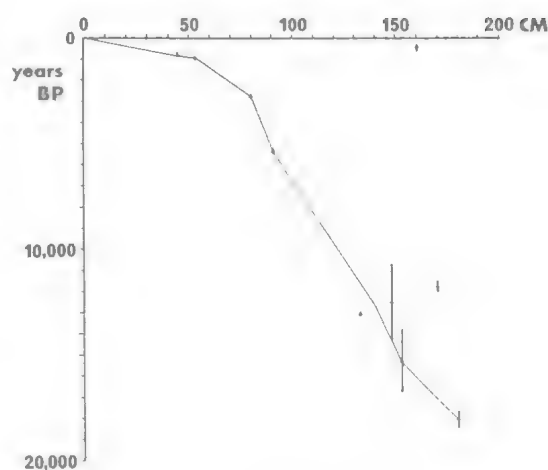


FIG. 36. Depth-age curve drawn by linking the various radiocarbon dates.

chaeological practice during the 1970s). This creates difficulties for the creation of high-resolution depth-age curves (a point acknowledged by Rosenfeld [pers. comm., 1990]). Similarly, the techniques employed in 1974 entailed, as was also common practice at the time, the use of relatively large excavation squares (1m x 1m) and fairly thick excavation units (5cm). Consequently, it is difficult to pin-point the timing of apparent changes. This is compounded by the failure to convert raw data into deposition rates in the original report, and by the absence of important numerical data which may have allowed such calculations to be made from the site report. We have, therefore, again used the depth-age curve (Fig. 36) to convert the raw data into deposition rates. All dates were used in creating the depth-age curve, except for ANU-1564, which is clearly anomalous, and ANU-1442, which is located above a localised depression in the underlying bedrock. The means of samples ANU-1441 and ANU-1566, located near each other stratigraphically, were also obtained. All other dates were taken as reported in Rosenfeld et al. (1981: 10-12). As the report does not present data on spit depths or mean layer depths, the latter were calculated from the stratigraphic diagrams presented. All deposition rates were calculated by relating the raw frequencies of excavated cultural material presented in Rosenfeld et al. (1981) to the ages of each layer which were interpolated from the depth-age curve (Tables 26, 27, Fig. 37).

During the early occupation levels, stone artefacts tend to be amorphous. Rosenfeld et al. (1981) reported significant increases in their

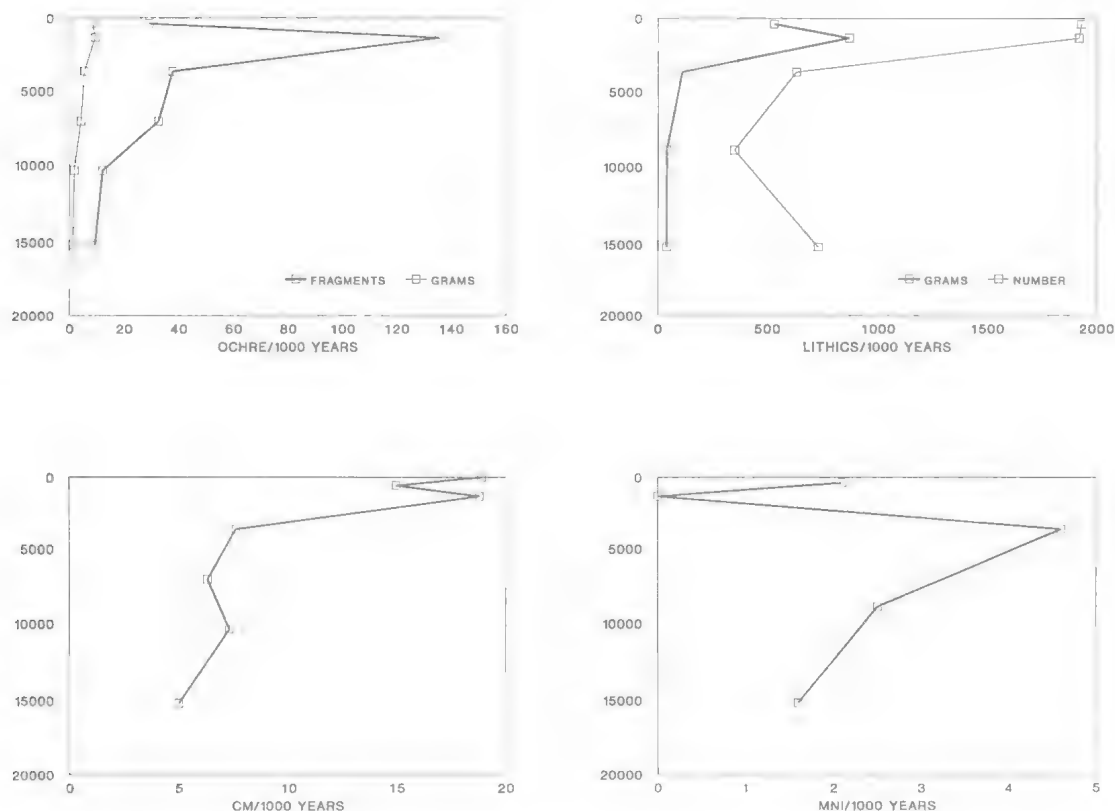


FIG. 37. Early Man Rockshelter: deposition rates (per 1000 years).

numbers, as well as in the amounts of ochre deposited (but not in their rate of deposition), in Layer 6. This was accompanied by a curious decrease in amounts of bone in the top layers. The latter was tentatively explained as partly reflecting taphonomic and sampling problems by Horton (Rosenfeld et al., 1981), whereas Walters (1984) argued that it probably signified the destruction of bones by dingoes, which arrived in Australia c.4,000-3,500BP (Gollan, 1984; Solomon & David, 1990). On the other hand, Watson & Flood (1987) and Watson & Abbey (1986) have shown that termites can destroy buried bone, and they have therefore explained the relatively low proportions of bone from the recent deposits at Early Man as a result of termite-induced bone destruction.

Consideration of deposition rates (i.e. deposition per unit of time) suggests that these changes date to the late Holocene, rather than the mid Holocene as suggested by Rosenfeld et al. (1981). It is not possible to precisely define the timing of changes at the Early Man site, because the prob-

lems inherent in the use of depth-age curves and the coarseness of the analytical units used do not allow this. The commencement of increased deposition rates, however, occurred sometime between 5,500 and 1,800BP. After 1,800BP, stone artefact deposition rates increase three-fold, as do rates of ochre deposition. Burrens adzes also make their first appearance sometime between 5,500 and 1,800BP. There is no evidence for hardwood-working tools (burrens and heavy step-flaked implements) before this time. This change is associated with a 'marked and relatively sudden' (Rosenfeld et al., 1981: 25) appearance of smaller tools, and an increase in the numbers of discrete stratigraphic lenses and charcoal concentrations, implying systemic changes involving a broadening of the typological tool kit as well as increases in deposition rates. Although it is not possible to determine exactly when these changes first appear at Early Man, the fact that deposition rates increase only slightly from Layer 7 (11,850-5,500BP) to Layer 6 (5,500-1,800BP) indicates that it is unlikely that these increases commenced

much before 1,800BP (Table 27). This is despite the fact that Rosenfeld et al. (1981) had argued that burrens first appeared c.5,000BP. Importantly, this period also witnessed a major increase in deposition rates of ochre, which may indicate a mid to late Holocene antiquity for the systematic creation of paintings in the site.

Deposition rates of all cultural materials, except for bone, peak during the mid to late Holocene, followed by a decrease in ochre deposition rates after c.1,000BP (but not of other cultural materials). This is accompanied by the appearance of parallel-sided bladelets sometime between 5,500 and c.1,000 years ago, implying that important changes continued to take place throughout the late Holocene. Given the large numbers of paintings on the shelter wall, this is likely to indicate that the majority of paintings at the site were painted sometime during the mid to late Holocene, probably after approximately 1,800BP and before c.1,000BP, as argued above.

YAM CAMP

Yam Camp is a sandstone rockshelter located near Shepherd Creek, a tributary of the Little Laura River (50km southwest of Laura). The site was excavated by Morwood (1989a, 1989b) in July 1989, as part of a larger project which attempts to 'use the evidence of art, stone artefact technology and resource use to obtain a more integrated model for the prehistory of the Laura-Cooktown region' (Morwood, 1989a: 71). He states his aims for excavating Yam Camp and other sites from the region as to:

'1, model 'recent' patterns of Aboriginal landuse on the basis of resource character, resource distribution and ethnographic data. The results will be used to establish the likely role of individual sites and the significance of 'recent' archaeological deposits as a baseline for assessing longer-term change.

2, define a detailed rock art sequence for the region using a variety of evidence from excavations, rock art content, superimpositions, and radiometric determinations of associated mineral coatings.

3, examine the relationship between changes in Aboriginal art, economy, technology, site use and palaeoenvironmental fluctuations. (Sites with good preservation of organic remains are a priority in the excavation program).

4, use patterns of chronological change in sites, as well as organisational relationships between sites and resource structures, to investigate the

prehistory of Aboriginal landuse systems in the region.' (Morwood, 1989a: 71).

Clearly, his research design is of great interest to our concerns.

Yam Camp is composed of two major stratigraphic layers, the uppermost of which is up to 24cm thick, consisting of fine ashy sediments and rich in cultural materials. The upper unit was dated approximately to the last 1,000 years. The lower layer contains coarse sediments and little cultural material, and appears from 24-115cm below ground surface (Huchet, 1990a: 57-59). Cultural materials have been obtained throughout the sequence (Huchet, 1990a: table 1), although ochre does not appear until the upper part (Pearson, 1989: table 2). Pearson concluded from his technological analysis of stone artefacts from Yam Camp, that '*... the artefactual assemblage comprised large (up to 80x90cm) chunky cores and flakes from the lower levels (Spits 7-18) which date to approximately 17,000BP near the basal layer, at a depth of 80cm, and significantly higher numbers of smaller cores, flakes, blades and flaked pieces, produced by both bipolar and non-bipolar techniques, and some ground-edge axe fragments from the upper levels (Spits 1-6) dated to approximately 1000BP at the base of spit 6. ... Raw material use was found to be relatively constant throughout the sequence ... A general trend towards smaller artefact size in all raw materials was also evident in the upper part of the sequence.*' (1989: 97-98).

Quantities of stone artefacts, bone and charcoal are significantly higher during the upper six spits, although it is not certain whether or not the differences in amounts of bone and charcoal between the upper and lower deposits are due to non-anthropogenic taphonomic processes. The precise nature of changes in deposition rates, stone artefact types and resource structures have not been reported and will have to await Morwood's full report.

SANDY CREEK 1

Sandy Creek 1 is a sandstone rockshelter located to the southwest of Laura. Like Yam Camp, it was excavated by Morwood in 1989 as part of the research design outlined above (Morwood, 1990a; Morwood & Trezise, 1989). Morwood and Trezise (1989: 77) reported that an excavation was undertaken at the site by P. Trezise in the 1960s, removing '*the uppermost, artefact-rich deposits in the shelter to an average depth of 75cm to expose panels of partially-buried, pecked engravings at the rear of the shelter. In addition,*

a trench 8 feet long by 6 feet in width was excavated from the rear wall to the dripline. This work was executed with little stratigraphic control and remains unpublished except for Morwood's (1990a; Morwood & Trezise, 1989) recent documentation of these events.

Morwood re-excavated Sandy Creek 1 for two main reasons. Firstly, the peckings at the site were reminiscent of those at Early Man, dated to the late Pleistocene, and secondly, Trezise claimed to have found an edge-ground axe at the bottom of the deposits. If the apparent age of the engravings was any indication, the base of the deposits was likely to be of considerable antiquity, and thus Trezise's findings may indicate the presence of very old axes in southeast Cape York Peninsula. This opened-up the possibility that the axes were comparable in age to Pleistocene axes found in Arnhem Land, and thus may be evidence that the two regions were linked by a more or less unified information exchange network during early times (Morwood & Trezise, 1989). Excavations at the site by Morwood were thus aimed at investigating the older deposits.

Only preliminary results of Morwood's (1990a; Morwood & Trezise, 1989) excavations have been presented. Six stratigraphic layers and two main sedimentary units are identified, with a near-basal date of $31,900 \pm 700/-600$ (Morwood, 1990a: fig. 2) (note that in Morwood [1989b: 156] this date is reported as $31,900 \pm 690$). Morwood & Trezise reported: '*... there are two main sedimentary units at the site, a sand sheet approximately 175cm deep and an underlying concreted sandstone rubble which extends to a bedrock of deeply-weathered white sandstone at a depth of 265cm ... Both the sand sheet and the rubble are colluvial, derived from coarse stratified sandstones which occur on a higher ridge behind the shelter. Within the sand sheet is an upper grey layer some 60cm deep which contains a high density of stone artefacts, ochre and charcoal. Seed grindstones, microblades, backed blades, and burren adze slugs are restricted to this grey sand. Below this is an orange sand, which is generally lower in artefact, ochre and charcoal density, but exhibits definite occupational horizons corresponding to periods of apparent shelter use and abandonment. The earliest of these begins just above the rubble at a depth of 140-175cm.*' (1989: 81).

Radiocarbon dates and stratigraphic diagrams presented in a later paper (Morwood, 1990a: figs 1, 2) place the antiquity of the basal rubble layer from shortly before 32,000BP to shortly after

$8,320 \pm 120$ BP, after which sandy sediments appear. The upper, culturally rich grey sand layer begins sometime between radiocarbon dates of $1,890 \pm 70$ BP and $1,230 \pm 50$ BP, indicating a similar temporal trend to that documented from Yam Camp. Morwood has not yet presented results to further define these trends, but it is significant to note that the documented changes cannot solely be explained by changes in sediment depositional regimes, as the major period of sedimentary change — from coarse rubble to sand — begins around 8,000BP. It is not until some 6,000-7,000 years after the major changes in depositional regimes take place that the main cultural changes are documented. Sandy deposits are present through most of the Holocene, but it is not until the late Holocene that the major technological and typological innovations, as well as significant increases in the deposition rates of cultural materials, take place. The implications of these findings are that the documented cultural changes were not solely caused by taphonomic factors. They further suggest that the changes cannot readily be explained by exclusive reference to environmental alterations.

OTHER SITES

A number of other sites have been excavated in the Laura region, but have not yet been published. These include Platform Gallery, excavated by Woolston & Trezise in the 1960s (Woolston, 1965), and five rockshelters recently excavated by Morwood (pers. comm., 1993) (Magnificent Gallery, Red Bluff Rockshelter, Red Horse Rockshelter, Giant Horse Gallery and Sandy Creek 2 Rockshelter). Because of a lack of information on these sites, we have not been able to include them in this analysis.

BARE HILL

Bare Hill (Davies Creek) is situated 195km southeast of Laura, along the upper western slopes of the Great Dividing Range. A rockshelter formed under a small granite boulder overhang in wet sclerophyll forest, on the margins of the rainforest, was excavated by Wright (1971) in the mid 1960s. Unfortunately, the excavation results have never been reported, although Wright (1971: 139) noted that marine shells were imported into the site for flaking (closest distance to the coast is 30km).

DISCUSSION

More rockshelters have been excavated from the Laura region than from most other parts of Australia, but few detailed site reports have yet appeared in press. Consequently, although a temporal framework is emerging, it remains ill-defined and subject to an inadequate sample size complicated by chronostratigraphic problems in some sites. Nevertheless, the apparent temporal patterns are broadly comparable to those documented from other parts of the region. The most obvious archaeological changes repeatedly occur during the mid to late Holocene, although differences also exist in the timing of changes in stone technologies and formal typologies, in intensities of painting activities, and in the rates of deposition of various cultural materials. It is unfortunate that a lack of adequate, fine grained data precludes a better temporal definition of apparent late Holocene trends.

The major change in stone artefact types at Laura is the appearance of the burren adze during the late Holocene. At Mushroom Rock, Wright (1971) documented their appearance some 3,000 years ago, although he does not provide sufficient data to enable us to adequately assess the margin of uncertainty associated with this date. To a somewhat lesser degree, a similar problem exists for the Early Man site, where Rosenfeld et al. (1981) argued that they first appear after approximately 5,000BP. We have questioned this chronological framework because of chronostratigraphic problems. In re-analysing the Early Man data, we concluded that it was not possible to define the first appearance of burren adzes at the site beyond a broad time frame dated to sometime between 5,500 and 1,800BP.

Morwood's excavations at Sandy Creek 1 have produced better defined chronologies. Here, burren adzes occur in the upper 60cm only of the excavated sediments, dating their appearance to sometime between $1,890 \pm 70$ and $1,230 \pm 50$ BP. Again, however, the absence of a full site report precludes the full assessment of these results.

In each of the sites discussed above, the appearance of burren adzes is clearly associated with significant stratigraphic changes — many of which are anthropogenic — although again the degree of temporal synchronicity cannot yet be determined (particularly problematic at the Early Man and Mushroom Rock shelters). It is notable, however, that not all documented changes are contemporaneous. Hence Rosenfeld et al. (1981) and Pearson (1989) noted that blades and blade

technologies first appeared at the Early Man Rockshelter and Yam Camp in levels dated to approximately 1,000BP — at least 1,000 years after the appearance of burren adzes — implying processes not adequately characterised by a two-fold sequence separating the late Holocene from earlier cultural practices. Were innovations to have appeared earlier in the sequence, they may have been lumped into a broader chronological unit (e.g. the Pleistocene). This, however, does not negate the fact that the number of typological innovations apparent during relatively recent times is significantly greater than during earlier times. Not only are these changes evident in southeast Cape York Peninsula, but they are even more so in other parts of Australia, where the Small Tool Tradition has been reported with even greater vigour (e.g. Central Queensland Highlands [e.g. Morwood, 1979; Mulvaney & Joyce, 1965] and NSW coast [e.g. Hughes & Lampert, 1982]). In the Laura region, the emergent pattern involves historical trajectories showing significant technological and typological alterations beginning sometime between approximately 5,000 and 3,000BP, and culminating in fully-blown new systems by approximately 2,500–2,000BP, with continued dynamism during the course of the late Holocene. In this sense, the late Holocene sociocultural sequence of the Laura region — as applied at least to stone artefact production and possibly use — can perhaps be categorised as dynamic, contrasting with earlier, relatively more steady state practices (although changes also took place during the latter).

Associated with these changes are significant increases in the deposition rates of a number of cultural materials. At the Early Man site, stone artefact, charcoal and ochre deposition rates begin to increase sometime between 5,500 and 1,800BP, and probably towards the end of this period (as is the case for changes in stone artefact types). After 1,800BP, this trend accelerates, with stone artefact deposition rates increasing threefold. Similar increases are documented from Yam Camp after approximately 1,000BP, while at Sandy Creek 1 they are dated to sometime between $1,890 \pm 70$ and $1,230 \pm 50$ BP. Charcoal and ochre deposition rates show similar trends at all sites.

It is clear — and as far as the north Queensland data are concerned, an as yet uncontested conclusion — that the late Holocene witnessed ever changing sociocultural and occupational strategies both quantitatively and qualitatively different from those of earlier times.

TEMPORAL TRENDS IN SOUTHEAST CAPE YORK PENINSULA PREHISTORY: TOWARDS A REGIONAL SYNTHESIS

It is intriguing — and highly significant — that most of the research projects undertaken in north Queensland have concentrated on the excavation and analysis of deposits which appeared to contain old or deep sequences. For example, Beaton's work in Princess Charlotte Bay and the Flinders Island group involved excavations at three rockshelters which indicated the greatest promise of deep sequences, and focused upon the *origins* of the large, mounded middens commonly found on the chenier plain. In a similar vein, Flood's excavations in the Koolburra Plateau concentrated on the excavation of the deepest known archaeological deposits, while Rosenfeld's work at the Early Man site followed from Trezise's conviction that it was likely to be among the oldest known rock art sites near Laura (hence the site's name). Morwood's recent excavations in the Laura region also entailed an investigation of potentially ancient sites, although his research aims were broad and also included a concern for recent sequences. Morwood was encouraged to excavate at Yam Camp and Sandy Creek because of the patinated engravings reminiscent of those dated to pre-13,000BP times at Early Man. Because of these similarities, they promised equally ancient deposits.

Campbell's excavations at Walkunder Arch Cave are part of a broader research project entitled 'North Queensland prehistory: a search for late Pleistocene and Holocene sequences' (Campbell, 1984). Like most of the other projects undertaken in the region, it is not concerned specifically with recent sites, but with those possessing relatively deep sequences allowing the investigation of trends over long periods of time. The fieldwork undertaken in the Mitchell-Palmer, Ngarrabullgan and Rookwood-Mungana-Chillagoe subregions also focused on obtaining relatively deep sequences, of considerable time depth, so as to allow investigations of temporal trends (at site, subregional and regional levels). More specifically, Hearth Cave and Fern Cave were chosen for excavation to test whether patinated peckings, of forms similar to those found at the Early Man site, were equally as old throughout the peninsula. Consequently, none of the above research projects can be said to have focused on the inves-

tigation of relatively recent times. In most cases, sites which appeared recent — such as surface sites and rockshelters possessing shallow deposits — were almost entirely ignored, thus skewing sampling procedures towards older deposits. No excavation has yet been reported of such recent deposits, although they form the vast majority of sites in all parts of the region.

This focus on relatively early sites and/or deep deposits is common practice in Australian archaeology. Yet, despite this, all of the excavated sites in north Queensland, with the exception of Fern Cave, have revealed increased deposition rates of cultural materials (and in most cases of general sedimentation rates as well) during the mid to late Holocene. This pattern has emerged irrespective of the approaches followed, or of the precision and reliability of the data presented. From this alone, it can be concluded that something quite significant, and different to that coming beforehand, was taking place relatively late in the prehistory of Cape York Peninsula, from Princess Charlotte Bay in the north to Chillagoe in the south. Within this context, we now synthesize the site and subregional trends to set the scene for a regional prehistory of southeast Cape York Peninsula.

TOWARDS A REGIONAL SYNTHESIS

One of the notable aspects of archaeological sequences from all parts of southeast Cape York Peninsula is the fact that with only one exception, no major changes in deposition rates, stone artefact typologies, settlement patterns or site types comparable to those observed during the late Holocene have yet been documented from Pleistocene contexts. The exception is Fern Cave which, as already seen, possesses unusual environmental properties. These late Holocene trends may be, of course, a function of the general lack of finely stratified deposits from Pleistocene levels, which severely limits our ability to differentiate clear temporal units during early times (see the section 'time and temporal scaling' below). This explanation, however, is unsatisfactory. Even in some poorly stratified sites (e.g. Echidna's Rest), the mid to late Holocene cultural deposits are still very different from those of earlier times. Furthermore, at some early sites (e.g. Ngarrabullgan Cave), where the Pleistocene levels are well stratified, major changes are still only evident during the last c.5,000 years. In addition, occupation in many rockshelters only begins during the mid to late Holocene (e.g. Endaen, Walaemini

and Alkaline Hill [Princess Charlotte Bay], Mordor Cave [Mitchell-Palmer limestone belt], and Initiation Cave [Ngarrabullgan]).

We would argue, therefore, that our failure to detect major changes during the early stages of north Queensland prehistory may be largely due to the overwhelming presence of changes during relatively recent times. The amplitude of the latter appear so marked that previous archaeological deposits seem static by comparison. This need not be due to a lack of change *per se* during the Pleistocene and early Holocene, but may be a result of the more subtle nature of the changes that took place during that time. In short, it is argued here that the differences observed between the Pleistocene and early Holocene, on the one hand, and the mid to late Holocene, on the other, are real. This is despite the fact that we may have wrongly characterised Australia's early prehistory by our failure to adequately research the nature of change during this time. We do not, however, focus on these more subtle changes here. Rather, like others before us, we have concentrated on the broad or general changes which have been documented from the various sites excavated in north Queensland. These changes are summarised below.

DEPOSITION RATES

One major change to have taken place in most of the sites excavated is that of unprecedented increases in deposition rates of cultural materials during the mid to late Holocene. Increases of equivalent magnitude were not detected in earlier periods. Such increases begin at various times between c.5,400 BP (e.g. Ngarrabullgan Cave) and 1,800-950BP (e.g. Early Man Rockshelter), although most take place during the last 3,800 years or so (Table 28). There are no clear geographical trends to these temporal changes, beyond the fact that they all take place within a limited time frame (but see below). It is also to be noted that there is no evidence that they were reversed during more recent times, keeping in mind that in some excavations, post-contact (and post-abandonment) surface and near-surface layers have been mixed with the upper occupation layers. In addition, the documented increases in deposition rates have been observed in a number of different types of cultural material, including stone artefacts, bone, charcoal and ochre, as well as in sedimentation rates (but see discussion of the Early Man site). Consequently, the observed changes may have been systemic in scope, in the sense that they not only took place throughout the

region, but also that they affected a broad range of material remains. What these increases mean in terms of human behaviour remains uncertain, but will be explored further below.

STONE ARTEFACT TYPES

The vast majority of stone artefacts recovered from all sites are amorphous in shape, with few recognised types identified. Morwood (Morwood & Trezise, 1989) claimed that ground-edge axes occurred throughout the region, perhaps since the beginning of occupation in the area, but the evidence for this is sparse and remains uncertain. The only firm evidence for the appearance of new artefact types dates to the mid and late Holocene, when burren adzes, bladelets and some rare backed blades make their appearance in the archaeological record. Some other, rare types also appear at various times during the late Holocene (e.g. a thumbnail scraper at Echidna Shelter between c.2,500 and 1,500BP), but these tend to be one-off cases, which cannot, therefore, be treated as representing the beginnings of new industries or types. The same can be said about the backed flakes reported from Walkunder Cave's Pleistocene deposits (Campbell, 1984).

Burren adzes, like increases in deposition rates, begin to appear in the archaeological record at various times during the mid to late Holocene (Table 29). No other types have yet been systematically reported in significant numbers from any site, although Rosenfeld et al. (1981) and Flood & Horsfall (1986) reported that blades also appear during relatively recent times at Laura and in the Koolburra Plateau. These are discussed as technological innovations below.

STONE ARTEFACTS: RAW MATERIALS AND TECHNOLOGIES

Although technological investigations of lithic material are a potential avenue of enquiry for the investigation of temporal trends, they remain largely unexplored. Their great potential stems mainly from the fact that technological practices are behavioural conventions that guide the production of specific forms (e.g. blades). That is, they express broad production methods, and not simply the manufacture of unique artefact types. Unfortunately, however, to date most site reports have lumped the vast majority of stone artefacts into an amorphous category with few, if any, diagnostic traits.

Nevertheless, some general trends have been observed by a number of authors. Rosenfeld et al. (1981) noted that at the Early Man site, there is a

gradual trend towards an increasing use of chert, as well as towards the manufacture of smaller artefacts through time. Similarly, Flood & Horsfall (1986: 28) noted that '... *chert replaced quartzite as the preferred raw material during the last millenium ...* ' at Echidna Shelter. These changes were not associated with changes in the mean sizes of artefacts at Echidna Shelter. Wright (1971) has also reported a decrease in mean stone artefact weights after c.3,000BP at Mushroom Rock, and Pearson (1989: 97-98) reported '... *a general trend towards smaller artefact size in all raw materials ...* ' in the upper part of the Yam Camp sequence (dated to <1,000BP).

The only other major change reported, with implications for technological considerations, is the first appearance of so-called blade technologies during the mid to late Holocene. At Early Man, this takes place sometime between 5,500 and 1,000BP, with the appearance of parallel-sided bladelets and a single prismatic core, which Rosenfeld et al. (1981: 22) concluded '... *probably form a part of the technological innovations which appeared from level 6 up* '. Pearson (1989) reported a similar trend with the appearance of blades in the upper levels (post-1,000BP) at Yam Camp, while Morwood (1990a; Morwood & Trezise, 1989) noted that microblades first appeared at Sandy Creek 1 in the upper grey layer, dated to sometime after 1,900-1,200BP.

In short, although technological questions have not been systematically addressed, a pattern of change is emerging. It is best characterised, at this stage, by a decrease in mean artefact weights at a number of sites, especially since c.1,000BP. It is associated also with a change in the selection of raw materials (increased use of chert) in some sites, as well as with the beginnings of new blade technologies (including the first appearance of prismatic cores, blades and microblades). The latter have been observed on a range of raw materials (including quartz).

PAINTING ACTIVITIES

An important issue, to which we shall return in later sections, is the evidence for change in painting activity. Significant increases in ochre discard rates have been documented from most sites during the mid to late Holocene, implying increases in painting activities during this time (Table 30). At some sites (e.g. Hearth Cave), late Holocene deposition rates are twenty times their previous values as measured by weight, and more than forty times by numbers of fragments. Never-

theless, at Early Man, such increases are followed by a decrease since 1,000BP. This recent decrease is difficult to interpret, as the upper unit also contains sediments accumulated during the last few decades (the post-contact period). Similarly, although increases were observed in the upper units at Fern Cave, they have proven difficult to date, as the entire Holocene period is contained within the upper two excavation units.

The implication of this general pattern is that the production of painted art within caves and rockshelters increased throughout southeast Cape York Peninsula during the late Holocene, and during the last c.1,000 years in particular. Flood's (1987: 117) conclusion that '... *a flowering of the ... stencil and painting art ...* ' is evident during the later stages of occupation in the Koolburra Plateau may thus also be valid for southeast Cape York Peninsula in general. Nevertheless, it is not clear whether these increases in ochre relate to cave paintings and/or to other forms of decoration (e.g. body painting).

SITE TYPES

With the exception of the South Mound (Princess Charlotte Bay), all of the other excavated sites are rockshelters or caves. It is therefore difficult to make any general statement relating to changes in site types, although even here an important observation can be made. Beaton's (1985) investigations at Princess Charlotte Bay include a series of basal dates for mounded middens. Seven such mounds are reported to have been investigated, none of which date to before c.1,700BP. This is an important point as the chenier plain on which mounds were constructed was in existence since at least 4,000BP. This issue is further explored below.

RESOURCE EXPLOITATION STRATEGIES

The commencement of systematic mound construction at Princess Charlotte Bay c.1,700 years ago represents more than just the beginning of a new site type. The mounds consist almost exclusively of a single shellfish species, *Anadara granosa*, which can be found in the mangrove beds near the chenier plains. Consequently, the mounds are at once testimony to the foraging practices of local people, their disposal patterns, and their site locations (base camps, consumption bases etc.). The systematic exploitation of mangrove beds (especially *A. granosa*) implies the beginnings of specialised and focused subsistence strategies. These are unlikely to have had comparable historical precedents, given that, in

spite of concerted efforts, no earlier evidence for such a scale of focused prehistoric activity has yet been obtained from the area. While a marine based economy during earlier times is evident in a concentration on marine resources in the early deposits at Alkaline Hill, Endaen and Walaemini rockshelters, the intensities of shellfish exploitation at these sites are not comparable with those reached in the mound economies. Hence, while the seeds for the targetting of *A. granosa* beds may be evident in the marine based economies represented in the rockshelters (dating to c.4,700BP), the focused and intensive exploitation of *A. granosa* only reaches a peak after the advent of mounded middens at Princess Charlotte Bay, c.1,700BP.

The only other evidence at hand for the presence of specific foraging strategies come from Echidna's Rest and Walkunder Arch Cave near Chillagoe. Here, a specialised strategy focusing on the hunting of non-juvenile rock wallabies (*Petrogale* sp.), accompanied by a conspicuous neglect of the larger wallaroos (*Macropus robustus*), has been documented since c.3,700BP. It is important to note, however, that it is not known whether earlier foraging strategies were similar or different. The point to keep in mind here is the continuity of what appears to be a specialised foraging strategy during the course of the mid to late Holocene in the Chillagoe region (as represented by the archaeological records of two sites).

SETTLEMENT SYSTEMS AND RATES OF SITE ESTABLISHMENT

Of the 18 rockshelters from which radiocarbon dates have been obtained, only 13 have basal or near-basal dates. Mushroom Rock is poorly dated due to an absence of charcoal from the lower layers (although Morwood [pers. comm., 1992] is currently undertaking TL dating of the lower sediments), while the basal occupation deposits at Hearth Cave, Mitchell River Cave, Echidna's Rest and Pillar Cave are still to be excavated. Of the 13 sites whose basal occupation has been dated, a pattern exists, with a significant increase in the numbers of occupied sites occurring after c.4,000BP (Fig. 38). This pattern is all the more important given a tendency for archaeologists to aim their excavations at deep or potentially ancient cultural deposits (see above). A mid to late Holocene increase in the rate of establishment of new sites, and of the number of sites occupied, is thus apparent. The implication is of either an intensification in the use of the region, or of a shift from open sites to

rockshelters and caves during this time. The latter is unlikely, however, if Beaton's findings at Princess Charlotte Bay is any indication. Here, both the use of rockshelters and the beginnings of systematic mound construction peak during the mid to late Holocene. This suggests that an intensification of occupation within rockshelters during the mid to late Holocene was part of a broader pattern of change, involving a number of site types. It should be clear from the evidence presented above that this change in settlement trends is closely linked with changes in deposition rates, subsistence bases and technological innovations.

COMPARATIVE REGIONAL STUDIES

We have argued that north Queensland's mid to late Holocene prehistory witnessed changes unprecedented in scale or character. In the following pages, we will review a number of regional studies to see whether or not the temporal trends documented for southeast Cape York Peninsula are also evident in other regions. It is stressed here that our aims are to outline regional trends as they have been reported by others, not to re-analyse the primary data in any detailed fashion. These studies are presented from north to south.

THE NORTH QUEENSLAND RAINFORESTS

Archaeological investigations in the tropical rainforests immediately south of southeastern Cape York Peninsula have been undertaken by Horsfall (1987). Her work at Jiye Cave and the Mulgrave 2 site produced occupational deposits spanning the last 5,100 years. Plant remains were an important component of the excavated deposits, with the first appearance of poisonous plant food remains occurring in the uppermost 40cm of deposit at Jiye Cave (dated to the last 1000 years). Before that time, plant remains were present, but none were identified as toxic plants. Similarly, toxic plants first appear in the deposits at the Mulgrave 2 site around 2,000BP (Horsfall, 1987:263). These results are problematical, to some extent, in that organic materials within the deposits have been subject to considerable chemical breakdown, and therefore the deepest, and oldest, sediments may have suffered preferential disintegration of organic remains. Stone artefacts known ethnohistorically to have been associated with the processing of poisonous plant foods, however, were found in increasing quantities towards the upper levels of the site. Horsfall (1987: 266-7) thus concluded that '... the

absence of ... [specialised grindstones] in the older deposits [at Jiyer Cave] and the occasional presence of "expedient" grindstones may mean that intensive use of such plants is represented only in the uppermost deposits, probably within the last 1000 years ... the vertical distribution of stone artefacts possibly associated with complex processing appears to indicate that intensive use of toxic plants is relatively recent'. This change was accompanied by a roughly contemporaneous increase in occupational intensities, as measured by a significant increase in the numbers of occupied open and sheltered sites throughout the rainforest, and by significant increases in discard rates of cultural materials after 850-650BP at Jiyer Cave, and after 1,800-1,000BP at Mulgrave 2. These changes imply major alterations in diet breadths as well as of systems of land use. Nevertheless, although changes in subsistence practices may be implied, including at least the beginnings of intensive exploitation of toxic plants, Horsfall (1987: 269) warns that '... the archaeological evidence presented here does not provide an unequivocal indication of the first use of these toxic plants or of any definitely increasing intensity of their use'. The patterns observed should therefore be treated as suggestive rather than as conclusive, and warrant further research.

THE UPPER FLINDERS RIVER REGION

As with the findings reported above, Morwood's (1990b, 1992) research in the Upper Flinders River region to the immediate south and west of southeast Cape York Peninsula revealed broad changes in lithic technology and artistic behaviour during the mid to late Holocene. At Mickey Springs 34, a continuous 11,000 year sequence contained increases in stone artefact deposition rates after c.8,000BP, in the form of 'trends rather than threshold changes' (Morwood, 1990b: 19). This was followed by major increases in stone artefact deposition rates, the introduction of new artefact types, the appearance of large numbers of dense hearth deposits, and a broadening of the resource base

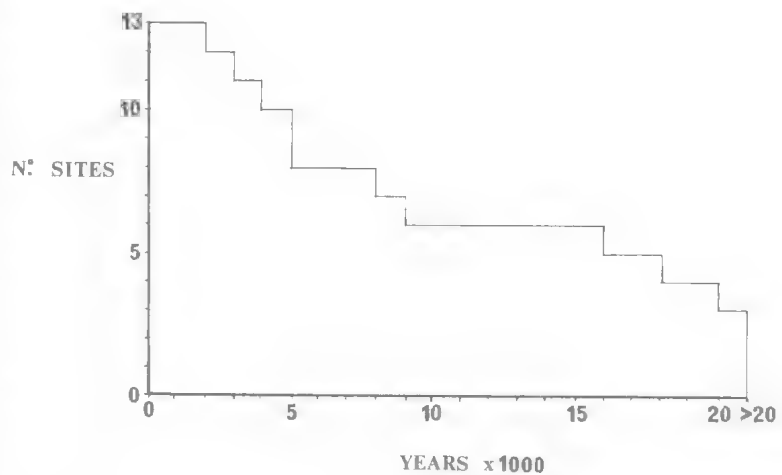


FIG. 38. Number of dated, occupied rockshelters, southeast Cape York Peninsula, in 1,000 year intervals.

c.3,400BP. Concurrent with these changes was a major increase also in the deposition rates of earth pigments, indicating changes in artistic activity at the site. Morwood (1990b: 14) further interpreted differences in the spatial distribution of artefacts across the site as possibly indicative of 'the establishment of more formalised patterns of site use and cleaning behaviour as occupation became more systematic and intensive' after 3,400BP. He concluded that: '... significant technological, economic and artistic change did not occur until 3360 b.p. The range of new artefact types and technologies included backed blades, and adzes of both burren and tula type, edge-ground axes, and (probably) grindstones. From this time there were further increases in stone artefact and ochre discard rates, use of conservation strategies in knapping high-quality stone and rate of hearth manufacture' (Morwood, 1990b: 21).

An important observation, which Morwood unfortunately does not elaborate upon, is that '... the evidence from Mickey Springs 31 shows that the nature and timing of this change is not site-specific. Here, 934 stone artefacts were recovered including three burren adze slugs, two tula adze slugs and two fragments of edge-ground axe, all of which came from post-5100 b.p. deposits' (Morwood, 1990b: 21). Yet in spite of the claimed contemporaneity of the changes at Mickey Springs 31 and 34, the reported 1,700 year discrepancy in timing for these changes remains unexplored, and may prove of greater significance to an understanding of the dynamics

of Upper Flinders River prehistory than is implied in the original report (see Discussion below).

Further support for Morwood's claims for broad, systemic changes in the Upper Flinders River during the late Holocene were obtained during excavations at Quippenburra Cave (Morwood, 1990b), where a 3,300 year sequence revealed cultural materials comparable to those found during post-3,400BP times at Mickey Springs 34. *'Overall, the evidence suggests use of the shelters by larger groups, for longer periods of time and for a wider range of activities over the past 3400 years ...', including a '... late Holocene commitment to seed processing ... [allowing] occupation of previously marginal country along Prairie Creek ...', changes also indicative of '... increases in local population and productivity'* (Morwood, 1990b: 22, 35). Although Morwood's published results are supported by only two excavations, it is hoped that excavations at Mickey Springs 31, 33 and 38 will produce the data to test his conclusions (Morwood, 1990b: 7).

THE CENTRAL QUEENSLAND HIGHLANDS

The antiquity of processing and management of toxic plant foods was addressed by Beaton (1977) for the Central Queensland Highlands. Here, a relatively consistent pattern of change appears. Of the nine excavated and dated sites, the earliest is Kenniff Cave, dating to c.19,000BP (Beaton, 1977; Morwood, 1979, 1981; Mulvaney & Joyce, 1965). A major characteristic of all sites is their tendency to exhibit punctuated, rather than gradual, change. This is most marked by the relatively sudden addition of new tool types c.5,000BP (the Small Tool Tradition), although the precise nature of technological and functional continuity between these and the earlier Core Tool and Scarper Tradition has never been investigated. A similar discontinuity took place even more recently, with the advent of the Recent Tradition (Mulvaney & Joyce, 1965; Morwood, 1979). The Core Tool and Scarper Tradition is represented in the Central Queensland Highlands mainly by a predominance of amorphous flakes (scrapers) and core tools, as well as by a low proportion of blades. Occupational intensities, as measured by artefact densities and sedimentation rates, are lower than for the subsequent Small Tool Tradition. These patterns have been reproduced at all four sites covering this time period — Kenniff Cave, The Tombs, and Native Well 1 and 2. Variations in the timing of changes between sites are minimal, a point noted

by both Mulvaney & Joyce (1965) and Morwood (1979, 1981). Not one of the main site reports records a gradual change from the earlier Core Tool and Scarper Tradition to the later Small Tool Tradition, although it has been repeatedly noted that items of the former continue in the latter (e.g. Mulvaney & Joyce, 1965).

The Small Tool Tradition is represented in the Central Queensland Highlands by the appearance of a wide range of new tool types, including backed blades, eloueras, unifacial points (including pirris), ground-edge axes, and the systematic production of grindstones. There is a concomitant increase in artefact densities, a peak in ochre deposition rates, and the appearance of technological innovations based on systematic platform preparation. In spite of the initial appearance of some of these traits c.5,000BP, they are most marked after 3,500BP, during the period which Morwood (1979) calls the late phase of the Small Tool Tradition.

This is also the time when cycads begin to appear in the archaeological record. Cycads first appear in the deepest levels at Wanderer's Cave (4,300BP), Rainbow Cave (c.3,600BP) and Cathedral Cave (3,500BP) (Beaton, 1977), implying their systematic exploitation and the beginnings of complex leaching technologies at that time (Beaton, 1977). Nevertheless, it is important to remember that Beaton (1977) did not excavate any site spanning both a pre-cycad and a cycad period. Although Morwood (1979, 1981) obtained longer cultural sequences, his excavations did not contain any evidence of cycads, making it difficult to determine the precise antiquity of their initial use in the region.

After 2,500-2,000BP, major changes continued to take place throughout the Central Queensland Highlands, with the disappearance of a number of stone artefact types (e.g. backed blades), and a decrease in artefact discard and sedimentation rates (Morwood, 1979). Morwood (1979) argued that these changes may have been associated with contemporaneous alterations in territorial networks, as changes in the distribution of rock art styles were also observed.

THE AUSTRALIAN ARID AND SEMI-ARID ZONE

Immediately to the west of the Central Queensland Highlands, the terrain loses elevation, rapidly changing to semi-arid and arid plains and dunefields stretching to central Australia and beyond. M. Smith (1988, 1989) recorded over 20,000 years of occupation in the arid zone, but it was not until c.3,000BP that major changes

took place in the pattern of arid-land occupation (see also Veth, 1989). A new suite of stone artefact types, including the systematic production of seed grinding stones (Allen, 1986; Smith, 1986) and tula adzes (contra Gould [1977]; see Hiscock & Veth [1991]), made their appearance at this time. Associated with these changes are significant increases in stone artefact discard rates in a number of sites, as well as in the numbers of sites occupied, implying increases in occupational intensities of parts of the arid zone. Smith (1988) argued that these changes were stimulated by increasing aridity of the broader region during the late Holocene, creating new opportunities which led to the development of new technologies (e.g. systematic seed grinding), which in turn increased production and thus overall Aboriginal populations. However, the coincidence of systematic seed grinding in the arid zone and changes elsewhere in Australia may imply that these changes were part of a broader trend, requiring explanations which go beyond the region's particular environmental circumstances. This is so especially given that the changes documented from the arid zone cannot be said to precede similar changes in other parts of Australia. We would also argue that the above point is compounded by the absence of seed-grinding during previous times of aridity (e.g. during the terminal Pleistocene). We thus suggest that broad alterations in Aboriginal population structures may be implied from the late Holocene changes observed in the Australian arid zone, but that these cannot be understood by treating the arid zone separately from the rest of Australia (see below).

MORETON BAY AND SOUTHEAST QUEENSLAND

The Moreton Bay region, located to the south and east of the Central Queensland Highlands, is situated in a different environmental setting. Given the proximity of the sea to coastal sites, the influence of changing sea levels on site survival has to be considered before occupational trends can be inferred from the archaeological record. Similarly, it is also important to ask whether observed changes reflect broader alterations in socio-cultural strategies, or whether they merely reflect the movements of people following the migrating shoreline (Hughes & Lampert, 1982). These issues are relevant to southeast Queensland, where Hall (e.g. 1982) and others (e.g. McNiven, 1990; Neal & Stock, 1986; Walters, 1989) have undertaken detailed research on settlement systems and foraging behaviour in a

broad suite of environmental zones (see also Morwood, 1987). The above authors have argued that, in spite of over 20,000 years of occupation, major changes occurred especially during the mid to late Holocene, and that this was evident in significant increases in artefact discard rates and in rates of establishment of new sites throughout the region. Furthermore, as Walters (1989) demonstrated, it is only during the last 3,000-2,000 years that complex stone fish traps make their appearance in the archaeological record (see also Frankland, 1990). Walters (1989) argued that this pattern is likely to be a true indication of changes in socio-cultural practices given a stabilisation of sea levels c.6,000BP.

The number of known occupied rockshelters increases during the last 3,000 years in southeast Queensland, with occupation in sites such as Bishop's Peak and Brooyar Rockshelter commencing at that time (McNiven, 1990). Hall & Hiscock (1988) also noted that important increases in artefact discard rates took place in rockshelters throughout the region. At Bushrangers Cave, Platypus, Maidenwell and Gatton rockshelters, Hiscock & Hall (1988) and Morwood (1986) reported initially low discard rates, increasing significantly after c.4,000-3000BP (see also Mowat, 1989; Novello, 1989). The numbers of coastal shell middens also increase during the late Holocene (Hall & Hiscock, 1988: 8). Changes in sea levels and the post-depositional attrition of sites, however, make it difficult to determine the precise implications of these increases. This problem is particularly acute in the Moreton Bay region, where active sand dunes and exposed beach lines can result in the rapid burial or destruction of archaeological resources. Until further information is presented by Hall and others, the pattern in the Moreton Bay region is tentatively characterised as indicating increases in tempo of site formation and discard rates of cultural materials after c.4,000BP (with this trend possibly beginning c.6,000BP). This is followed by further changes (mainly increases) in discard rates during more recent times (2,500-1,000BP), although this trend is more difficult to interpret given that very recent (post-European) sediments are often included in the upper units (Hall & Hiscock, 1988; Mowat, 1989; Novello, 1989). The probable establishment of new energy harnessing techniques (e.g. large, stone fish traps) during the mid to late Holocene is considered by some to be an important component of these changes (Morwood, 1987; Walters, 1989).

HUNTER RIVER VALLEY

In the Hunter Valley (NSW), Hiscock (1986) documented major changes during the mid to late Holocene. At Sandy Hollow, a mid Holocene period of intensified site use may have been followed by subsequent decreases during the last 820 years or so. Artefact deposition rates and rates of site establishment decreased during the latter period.

More recently, Hiscock (1993) argued that a new stone artefact reduction strategy, which he terms the Redbank A Strategy, began c.1,300BP (and possibly earlier). This technological innovation was associated with the systematic manufacture of backed blades, in particular bondi points. As he noted, however, '... stratigraphic uncertainties, and in particular suspicions of a hiatus at the base of level 4, make the estimate of 1300 years BP a minimum one for the appearance of this manufacturing strategy' (Hiscock, 1993: 71).

SOUTHEASTERN HIGHLANDS

Johnson (1979) has noted a conspicuous increase in intensities of site use in the Blue Mountains sometime after 4,000-3,000BP, an increase directly associated with the beginning of the Small Tool Tradition. Bowdler (1981) has argued that the highlands bordering the coastal regions of southeastern Australia began to be systematically used by Aboriginal people only during the last c.5,000 years, with a continued increase during the last 3,000 years or so. As Bowdler (1981: 108) noted, 'Aboriginal occupation of any intensity can only be dated to within the last 5000 years, concomitant with the inception of the Australian Small Tool tradition of "Bondaian" (i.e. backed blade) facies'. This period also witnessed the management of new resource bases, including the exploitation of some toxic plants such as cycads, which require specialised and complex processing procedures (leaching technologies). Using ethnographic documents to generate her model, Bowdler (1981) concluded that the systematic use of the eastern highlands (southeast Queensland highlands, New England Tablelands, Blue Mountains and Southern Uplands) during the mid to late Holocene was associated with ceremonial activities made possible by the advent of new methods for managing and processing high yielding and dependable (staple) food resources (e.g. cycads, daisy yams and bogong moths).

More recently, excavations at Birrigai yielded clear occupational deposits dating back to c.16,000BP, and less concrete evidence to

c.21,000BP (Flood et al., 1987; David, 1987). For the first time, pre-mid Holocene occupation levels in the region had been excavated. The temporal trends at Birrigai showed major increases in sedimentation rates, charcoal concentrations and artefact deposition rates after c.3,000BP, with further increases after c.500BP. Significant increases in the number of occupied rockshelters were also documented after c.3,000BP. These trends were interpreted by David (1987) and Flood et al. (1987) to reflect an increase in occupational intensities after c.3,000BP, involving increases in the use of individual sites (Birrigai), marginal environments (the highlands), and establishment rates of new sites. A late Holocene emphasis on southern highland occupation is consistent with Bowdler's earlier claims.

MANGROVE CREEK CATCHMENT

Attenbrow (1982, 1986) demonstrated broadly similar trends for the Upper Mangrove Creek catchment area. Her investigations are important because, for the first time, she systematically investigated differences in the timing of changes which had, until then, usually been assumed to have been closely interrelated. She concluded that while increases in the rates of site establishment and use occurred during the last 2,000 years, around 1,000BP artefact discard rates decreased significantly. She argued that there was a 'non-correspondence between typological phasing and points of change' (Attenbrow, 1986:13) in the region, implying that the observed changes were not a function of petrological, technological or typological changes. Two major periods of change at Upper Mangrove Creek were identified, the first dated to 5,000-3,000BP and the second to 2,000-1,000BP. Given these issues of, on the one hand, multiple, episodic change and, on the other, non-synchronous, multivariate change, Attenbrow argued that complex interpretations were needed, rather than general models or those based on single variables.

THE SOUTH COAST OF NEW SOUTH WALES

Hughes & Lampert (1982:16) noted an 'obvious contrast' between the numbers of documented Pleistocene and mid to late Holocene sites in the south coast of New South Wales, as well as significant increases in stone artefact and sedimentation rates within sandstone rockshelters (Hughes, 1977; but see Hiscock, 1986). They interpreted these trends as indicating gross increases in the occupation of the current

southeastern seaboard sometime during the mid to late Holocene. Given that the investigated sites and landscapes are located on stable landforms not subject to destruction by Holocene eustatic fluctuations, the documented increases were taken by Hughes & Lampert (1982) to reflect demographic expansions which probably gained momentum during the course of the late Holocene. The approximate — but not exact — coincidence, on the one hand, of numerical increases in the numbers of sites occupied, stone artefact and sedimentation rates, and, on the other, of qualitative changes in artefact types and extractive technologies (e.g. beginnings of line fishing and of the Bondaian stone industry), suggested to Hughes & Lampert that the changes were systemic, involving increases in the intensities of use of individual sites and of the regional landscape. Their conclusions were further supported by evidence for increased slope instability and by increases in numbers of charcoal particles in sediments from southern NSW valley systems, indicating increases in firing practices of the broader landscape c.4,000BP (Hughes & Sullivan, 1981). To Hughes & Lampert (1982), the implications were a rise in absolute Aboriginal populations.

SOUTHWESTERN VICTORIA

Lourandos (1980a, 1980b, 1983) argued that systemic changes took place in southwestern Victoria during the mid to late Holocene. More specifically, he argued that at Bridgewater South Cave, until recently the only pre-mid Holocene site reported from southwestern Victoria, rich and finely stratified cultural deposits dating to the last 500 years succeeded a generalised stratigraphic sequence containing low-density cultural deposits. There was an increase in the range of artefacts used at this time, including a significant increase in the proportions of modified flakes (tools). Increases in amounts of charcoal and faunal Minimum Numbers of Individuals (MNIs) also took place, along with increases in stone artefact deposition rates. Additionally, a broadening of the resource base may be indicated by a recent (post-500BP) increase in the use of marine resources, although, as Lourandos (1983: 84) noted, this may 'merely document the site's proximity to the sea (perhaps less marked in ... [the early phase])'. He concluded that the late Holocene period witnessed increases in intensities of human occupation at Bridgewater South Cave, and noted that this was matched by a similar, though not exactly contemporaneous, late

Holocene increase in occupational intensities at the Seal Point midden site at Cape Otway. As these changes were associated with major increases in the numbers of rockshelters, earth mounds and other site types used after c.4,000-2,000BP, Lourandos (1983) argued that the observed patterns may indicate the establishment of systematic, semi-sedentary occupation of the region after c.4,000-2,000BP. In formulating this conclusion, he also noted that: '... an examination of the nature of these sites indicates that the most complex sites (in terms of size and economic aspects) were established late in the sequence. For example, all the earth mounds are less than 2500 years old together with some of the larger shell middens and open sites.' (Lourandos, 1983: 86).

More recent investigations have generally supported the trends originally outlined above, although interpretations differ significantly (e.g. Bird & Frankel, 1991, despite their different views).

The late Holocene antiquity of earth mounds in northern and western Victoria has been well demonstrated by (e.g. 1982), Williams (1988) and Downey & Frankel (1992). Similarly, excavations by Lourandos (1980a, 1980b) at Toolondo, where large scale, specialised water management networks were constructed to divert water flow from swamp systems to a maze of fish-trapping installations, revealed their probable late Holocene antiquity, although their dating is problematic and relies on a single date obtained from the base of silted ditches forming part of the Toolondo system. Lourandos (1980a) argued that the drainage of swampy ground through the construction of large artificial channels heralds a late Holocene amplification of a specialised exploitative strategy — fishing — by taking advantage of the migratory runs of eels (*Anguilla australis occidentalis*). He concluded that the beginnings of systematic swamp management, as evidenced also by the late Holocene antiquity of the earth mounds (generally located in wetlands), enabled the penetration and habitation of wetlands by hunter/gatherers during times of flood, in particular the humid winter months.

The above points imply that the changes which took place during the last c.4,000-2,000 years in southwestern Victoria may have been broad and multifaceted. Lourandos (1980a, 1983) argued that these changes may have involved increases in occupational intensities within both individual sites and the broader region, as well as the commencement of artificial manipulation of resource zones, and an expansion of ecological niches. Such changes seemed to signify an increase in

degrees of energy harnessing during the late Holocene. It is this process of mid to late Holocene change which Lourandos (1983) coined an intensification of socio-economic variables for the later stages of Australian prehistory.

Lourandos argued that the changes observed in southwestern Victoria involved five major components:

- 1, an increase in the use of individual sites (measured by increased deposition rates of cultural materials within individual sites);

- 2, an increase in the establishment of new sites (measured by increases in the number of sites occupied within the region);

- 3, an increase in the use of marginal environments (measured by the relatively recent beginnings for the systematic use of some environments, such as wetlands and rainforests);

- 4, a diversification and increase in the complexity of resource management strategies (evident in the recent development of extensive water management installations targeting high fish yields); and

- 5, the beginnings of intensive and extensive communication networks (including formalised trade relations), linking various parts of mainland Australia into a complex set of alliance networks mediated via ritual and ceremonial activity.

INTERPRETING THE ARCHAEOLOGICAL PATTERNS

Major changes have been identified from the archaeological records of individual sites, sub-regions and regions of north Queensland. These changes are comparable in each case and appear to have been unprecedented in scale or character. Similar changes have been documented elsewhere in mainland Australia, including the arid and semi-arid zones to the southwest, and the Central Queensland Highlands, Moreton Bay and southeast Queensland, the Hunter River Valley, the Southeastern Highlands, the south coast of N.S.W., the Mangrove Creek catchment area and southwestern Victoria to the south. The observation that major cultural changes took place in southeastern Cape York Peninsula during the mid to late Holocene is therefore not unique in Australian prehistory. Nevertheless, a number of interpretations have been advanced to explain these patterns. We now review these and discuss ways to best evaluate the complex data upon which they are based.

PRESERVATION FACTORS AND ARCHAEOLOGICAL CATCHMENTS

A number of authors have argued that the low densities of pre-mid Holocene cultural deposits are due to their preferential destruction by natural processes. Cribb (1986), for example, argued that some landscapes are more apt to preserve cultural deposits than others (archaeological information traps), and that through the vagaries of time, early archaeological remains are unlikely to have survived in many parts of Australia. He saw the latter process as compounded by the particularly dynamic nature of Pleistocene and early Holocene sedimentation processes (see also Bird, 1992; Godfrey, 1989; Horsfall, 1987; Rowland, 1983).

While such arguments may be valid for individual time periods and places, we would argue that they cannot explain the general trends outlined above. For example, at some sites, such as Ngarrabullgan Cave, depositional and erosional regimes appear to have been stable for a considerable length of time, but general trends comparable to those outlined above are still evident. These trends are not only present in areas where geomorphological processes can be seen to be currently eroding away old sites, but they are equally pronounced within sites where there is no evidence of erosional stages. It would, furthermore, be difficult to argue that stone artefacts were absent from Pleistocene levels because of their preferential disintegration. All in all, the case against the preservation argument is perhaps best summed-up by Hughes & Lampert (1982: 24), who noted that '*... there is no evidence for any environmental change that would have so greatly altered the decay rate of sites*'. (See also Barker, 1991).

As Hughes & Lampert (1982), Lourandos (1983), Rowland (1983) and Barker (1989, 1991) have argued, it is fundamental that local environmental changes be considered when addressing issues of change in the Australian archaeological record. It is possible, for instance, that increases in occupational intensities in current coastal situations resulted from human populations following the migrating shoreline through the course of the Holocene, rather than from social or population changes per se (see also Barker, 1991). For this reason, we argue that the types of questions asked here cannot, and should not, be addressed by reference to sites closely linked with the current shoreline, unless the influence of changing environments on settlement-subsistence

systems can be accounted for (e.g. Barker, 1991; see also Head, 1987 for reference to inland sites).

EXPONENTIAL TRENDS

Bird & Frankel (1991) have argued that the occupational trends observed by Lourandos (1983) in southwestern Victoria during the late Holocene did not really take place. This, however, is in direct contradiction to Frankel's (1991: 146) own observation that '*... the lack of occupation in rockshelters between 7000 and 5000 years ago [i.e. increasing densities of cultural materials after 5000BP] may ... be real ...*' and that '*... certainly the current evidence is unequivocal. Mounds are a recent phenomenon*' (Frankel, 1991: 146), as originally predicted. Furthermore, we would argue that Bird & Frankel under-represented actual occupational trends for, in trying to address these trends, they plot every radiocarbon date obtained from the excavated sites in their sample onto a single graph. However, as they note, '*... more than half the sites have only one date, three-quarters have one or two*' (Frankel, 1991: 146). Given that most dates come from the base of excavated deposits, their graphs tend to show rates of site establishment, not occupational trends through time. To address the latter, it would be necessary to plot the number of sites occupied through time, such as in each 500 year period. Consequently, older deposits are probably over-emphasised in Bird & Frankel's (1991) quantifications. In spite of this, significant increases are still clearly apparent for a number of site types shown on their plots (Bird & Frankel, 1991: Fig. 3), and indicate a general pattern of increased site establishment (and use) since c.3,000BP.

REGIONAL AND SITE SPECIFIC CHANGES: THE PROBLEM OF SCALE

It is difficult to make general statements on the basis of a handful of sites. This problem was recognised by Frankel (1991), who argued that the changes observed by Lourandos (1983) in southwestern Victoria may be site-specific rather than regional in character. However, this does not account for the repeated nature of the trends in the various sites, sub-regions and regions examined above.

TIME AND TEMPORAL SCALING

The problem of scale may also unduly skew the temporal pattern in a different way. Elsewhere, Gingerich (1983) argued that rates of change may be critically patterned by the nature

of the temporal scales employed (see also Frankel, 1988). He argued that '*... rates measured over different intervals of ... time have been used ...*' to create arguments of change, but that '*... perceived evolutionary rates are a function of the time interval over which they are measured, and temporal scaling is required before rates measured over different intervals of ... time can be compared*' (Gingerich, 1983: 159). The problem is that mid to late Holocene deposition rates are largely calculated from radiocarbon dates obtained at intervals of less than 3,000 years, whereas earlier ones are often based on significantly longer intervals. Gingerich (1983: 159) notes that change will tend to be slow over long time intervals, as '*the shorter the interval of measurement, the more likely one is to observe high rates. The longer the interval, the more stasis and evolutionary reversals are likely to be averaged in the result. This effect ... systematically damps the values of rates calculated over longer and longer intervals*' (Gingerich, 1983: 160). In brief, relatively short-term fluctuations in artefact deposition rates, sedimentation rates, and so forth, do not register in long time scales, rendering inappropriate comparisons of change in relatively recent prehistory with those in earlier times.

Although the effects of time and temporal scaling cannot be ignored, we would argue that the observed archaeological trends, as outlined by numerous authors and which have been discussed above, cannot be attributed to these factors for two major reasons. Firstly, the apparent diachronic patterns involve significant changes in qualitative as well as quantitative data. The former is not obtained by transforming quantitative information into calculated rates, but pertains to specific points in time. For example, burren adzes first appear in the archaeological record at various times, but always during the mid to late Holocene. Similarly, Williams (1988), Lourandos (1983), Frankel (1991) and Downey & Frankel (1992) have argued that earth mounds first occur in western and northern Victoria c.3,000-2,500BP. Neither of these traits have ever appeared before these periods. And secondly, the apparent increases in rates of socio-cultural change still hold when the late Holocene and earlier periods are compared using similar time intervals (although this point warrants further exploration). For example, cultural levels dated from c.30,000 to over 37,000BP at Ngarrabullgan Cave show little evidence of change in cultural activity, even after dividing this period

into smaller temporal sub-phases, as defined by radiocarbon dates ($30,000 \pm 600$, $36,100 \pm 800$ and 'greater than 37,170' BP). In contrast, the mid to late Holocene level at Ngarrabullgan Cave, which covers a time span of c.5,100 years (compared with 6,100 years and >1,070 years for the Pleistocene levels covered by the radiocarbon dates), witnessed unprecedented changes in artistic activity and deposition rates. We argue, therefore, that significant changes are apparent during the mid to late Holocene period, and that these are largely independent of differences in the time intervals employed by archaeologists in investigating diachronic trends.

POPULATION INCREASES

Some authors, while accepting and elaborating upon the observation that the mid to late Holocene archaeological record is both quantitatively and qualitatively different from that of earlier times, have differed in their explanatory frameworks. In particular, Beaton's (1983) position has changed during the last 15 years or so, beginning with an early conviction that the observed changes implied alterations in social practice (Beaton, 1977). He later argued that social explanations were not sufficient to explain the archaeological changes, and that the trends indicated population increases alone (Beaton, 1983). Beaton argued that Aboriginal populations increased late in Australian prehistory as a result of 1) a specific founder population of limited size, 2) a specific generation time, 3) constant survivorship, 4) regulated budding-off, and 5) intrinsic growth rates. No acknowledgement was made, however, of internal, socio-cultural practices interacting with biological forces and thus serving to regulate population dynamics (Cowgill, 1975).

Beaton based his model of past populations in Aboriginal Australia on the assumption that population sizes are dependent on intrinsic growth rates checked only by external, environmental influences (Beaton, 1990). This in itself is rather simplistic, as Malthus (1982a, 1982b) recognised almost 200 years ago, when he argued for the importance of social relations, power structures and ideological systems (e.g., the checks of vice, of misery and of moral restraint) — in short, social and cultural factors — in regulating subsistence behaviour and population sizes. While it is not our intention to explore these issues in detail, their relevance to Beaton's argument is clear.

Beaton's (1983) model of population dynamics in Aboriginal Australia can thus be challenged on the grounds that:

- 1, the relationship between human population sizes and theoretical levels of 'maximum carrying capacity' has rarely, if ever, been adequately addressed (e.g. Anderson, 1978), and the notion of simple biological forces regulating human populations in interaction with extrinsic environmental forces is, at best, naive;

- 2, the distinction between a society's and an individual's needs and problems is fundamental to, but not considered in, Beaton's model (Cowgill, 1975; Hassan, 1981);

- 3, the concepts of 'need' or 'stress' are distinct from that of economic demand. Social and individual stress does not automatically create effective demand. Cowgill (1975) wrote: '*... even if human population growth were difficult to regulate, it would not follow at all that stress is caused by overpopulation ... [or that it] would be an effective incentive for responses of a developmental kind*';

- 4, Beaton's reliance on the five assumptions enumerated above is, therefore, flawed. As with Birdsell's (1957) prior employment of similar assumptions, none of these can be either practically or theoretically demonstrated. Irregularities in socio-economic regimes are critical to population dynamics, including changes in population composition (e.g. age and sex structures, family and household sizes, regional structures), marriage and reproductive rules, residence rules etc. (e.g. Coleman & Schofield, 1986; Lee, 1972; Lourandos, 1983; Ward & Weiss, 1976);

- 5, lastly, the archaeological record indicates patterns of change and stability in human actions, not population sizes. Changes in the archaeological record document changes in the ways people behaved (assuming adequate treatment of post-depositional and taphonomic factors). The mid to late Holocene archaeological record may be suggestive of population increases, but change in the latter implies changes in socio-economic practices (quantitative and/or qualitative). More correctly, they imply changes in the contexts in which such actions were undertaken (Lourandos, 1983, 1984; David, 1987).

INTENSIFICATION

The use of the concept 'intensification' in Australian prehistory is relatively recent. Although it was first employed by Hallam (1977), Beaton (1977) and Hughes & Lampert (1982) and others to loosely describe changes observed at a

local scale, it was not until Lourandos's work that it gained widespread attention. Lourandos (1980a, 1980b, 1983) interpreted the late Holocene changes documented from southwestern Victoria and beyond in terms of changes in subsistence practices, which may imply changes in either production or productivity. Unlike L. Binford (1968, 1983), who argued that intensification involved an external (environmental) stimulus directed towards solving subsistence needs, Lourandos followed Bender (1979) in that '*... intensification may simply be about improving accessibility, reducing travel time, or making returns more predictable. It need not be about food resources in particular, but about access to plants used for poison or for medicinal purposes or for cordage, or to animals for ritual, etc.*' (Bender, 1979: 205-206). In this sense both Lourandos and Bender deviate from more traditional definitions of intensification such as those of L. Binford (1968, 1983), Boserup (1965), Smith & Young (1972), and Brookfield (1972), all of which are directly concerned with productive efficiency.

Lourandos formulated his intensification model around two observations. The first was based on the ethnographic record, which documented relatively large population densities, semi-sedentism (including the use of earth mound bases), and large-scale ceremonial networks in southwestern Victoria. The latter involved periodic congregations of many hundreds of people from allied 'tribes' for lengthy periods of time. Such congregations required large-scale energy-harnessing technologies, such as the drainage (fishing) systems noted at Toolondo and surrounding areas (see above).

The second component of Lourandos's model involved the observation that during the late Holocene, many changes in land use, foraging strategies and settlement systems took place throughout southwestern Victoria. He concluded that since there was no evidence for large-scale fishing technologies such as those at Toolondo before this time, the social systems observed ethnographically were unlikely to have any great antiquity. As well, earth mounds (which appeared to be indicative of semi-sedentism) were of the last c.2,500 years only. Incentives to change were thus seen to arise '*out of the nature of the social relations*' (Lourandos, 1983: 91), and were explained in structural terms, as '*social relations primarily give rise to other cultural changes, such as economics, and thus must in some way precede them*' (Lourandos, 1984: 32). He argued

that these changes acted to amplify information exchange networks (e.g. congregation, ceremonial and large-scale, labour-intensive productive networks) and to increase productivity through increases in the complexity of the forces of production (e.g. the appearance of complex eel-trapping systems in southwestern Victoria) during the mid to late Holocene. He thus concluded that the documented archaeological trends represent changes in past social, political and economic practices.

ENVIRONMENTAL CAUSATION AND ADAPTIVE RESPONSES

Rowland (1983) disagreed with Lourandos's interpretations of the archaeological record. He argued that humans adapt to environmental circumstances, and therefore environmentally fluctuating systems will result in social and cultural change (Rowland, 1983: 63). He further noted that '*... environmental fluctuations did occur in the Holocene of Australia ...*' and, therefore, '*... such changes may have altered the range of alternatives available to Aboriginal people, resulting in dispersion and a great diversity of economic and social adaptations*' (Rowland, 1983: 74). Rowland concluded that the major changes observed in the archaeological record are a product of human responses to environmental changes.

While we would agree with Rowland, in that environmental alterations may lead humans to modify their behaviour, we cannot agree with his conclusion that the major changes observed in the Australian archaeological record necessarily indicate adaptive responses to changing environmental conditions. As already stated, we do not find adaptive arguments convincing, for all human behaviour occurs within environmental contexts. It could be said that all social systems are adaptive by virtue of the fact that they exist. To argue (or, rather, assume) that a system changes adaptively because of environmental change says nothing about the particular nature of the changes observed. Nor does it enlighten us about the causes of stability. For instance, why did the major archaeological changes take place after around 3,000BP, while the most dramatic environmental changes took place some 5,000 and 15,000 years earlier?

Rather, we would argue that while social changes may take place in response to environmental changes, the latter can only be taken as a context of change. There will be times when the particular nature of historical conditions (which includes

social relations, power structures etc.) encourage change, and other times when they do not. We need not go beyond our own social system to give examples of this general process. For example, some of the major changes which future archaeologists may face would probably include twentieth century technological innovations: computers, mass communication, transport networks and military build-ups. Do these, and other changes (take World War 2 for instance) require direct environmental causes?

In short, Rowland's model of change may be correct, in the sense that environmental changes may have stimulated social and cultural ones. However, humans do not respond to environmental changes mechanistically. It is only by considering the contexts of decision making that socio-cultural changes will be positioned in their proper historical perspectives. The task of archaeology is to shed light on those contexts. We cannot detach social and cultural strategies from the social, political and economic frameworks of which they are a part. Because of this, while it may be possible to argue that archaeological changes involved alterations in environmental contexts, or that they reflect changes in social or demographic factors, it may not be possible to determine ultimate causes (the stimuli that motivated the change). We will not be concerned with such stimuli herein.

INCREASES, DECREASES AND STRUCTURAL CHANGES

Bird & Frankel (1991) do not agree with Lourandos's view that the changes apparent during the late Holocene reflect increases in the sizes of settlements, duration of habitation within sites (increased sedentism) (but see Walters, 1989), and a broadening and intensification of exchange networks. They note that the documented changes may simply signify changes in seasonality and structure of site use, and therefore changes in settlement systems, rather than increases in intensities of site use. These issues, they argue, have never been adequately addressed.

While Bird & Frankel may be correct on this point, we would argue that the repeated increases in deposition rates of cultural materials found throughout mainland Australia during the mid to late Holocene probably indicates that broader factors are at work. The fact that these increases in deposition rates are approximately contemporaneous with increases in the numbers of sites used, as well as with a broadening of site types and the extensive use of new environments,

would suggest that the changes observed indicate increases in intensities of land use, rather than mere changes in schedules of land and site use.

Structural changes are not independent of the problem of timing. By this we refer to the apparent lack of synchronicity in the timing of the mid to late Holocene changes documented from various parts of eastern Australia. Hiscock (1986) has highlighted this problem in noting that in the Hunter River Valley, the Sydney Basin, and parts of the Northern Territory, the most recent period (dated to the last c.900 years in the Hunter River Valley) witnessed a decrease in stone artefact deposition rates, not an increase as widely assumed. David (1987) argued for a similar trend from sites in the Central Queensland Highlands, with decreases taking place during the last 2,000 years. In attempting to explain such differences in the timing of the observed changes, it was argued that inter-regional, demographic networks may have changed, in that a '*late Holocene de-intensification of the type documented by Hiscock involved an increased use of marginal environments*' during the late Holocene (Flood et al., 1987: 23), accompanied by a decrease in the use of former heartlands. It was therefore concluded that '*... a reorganisation of people through space*' (Flood et al., 1987: 23) may have taken place during the mid to late Holocene (David, 1987).

Walters (1989) has explored the above proposition by investigating occupational trends and the antiquity of complex fishery installations along the coastal and sub-coastal zones of southeast Queensland. He concluded that the '*occupation of the marginal coastal Wallum of southeast Queensland intensified after mid Holocene times, and the marine fishery developed at an exponential rate after 2000BP*' (Walters, 1989: 221), but '*... the evidence ... presented here does not fit the model proposed by Flood et al. (1987) for increased use of marginal environments and decreased use of favourable environments in late Holocene times. Though the present study supports their idea (and that of Hiscock 1986; Morwood 1986) of reorganization of people in the landscape, it finds no de-intensification of a heartland accompanying the intensified use of a formerly marginal environment. It suggests that an intensified use of a marginal environment accompanied a steady if not intensified use of the formerly more favourable hinterland*' (Walters, 1989: 222).

If Walters is correct, stone artefact deposition rates from sites in rich environments cannot be

said to increase in tandem with decreases in sites from neighbouring marginal environments. There may indeed be some places, such as the Central Queensland Highlands, where stone artefact deposition rates decrease in the upper levels of the mid to late Holocene, but the particular nature of such decreases remains to be investigated. In particular, it may be necessary to determine the extent to which post-abandonment, surface sediments have affected late Holocene deposition rates of cultural materials. Until these issues have been further addressed, it will not be possible to determine more precisely the relevance of apparent, recent decreases in deposition rates to overall temporal trends in Australian prehistory.

DISCUSSION

A number of important arguments have, therefore, been advanced to explain the broad changes observed during the mid to late Holocene in Australian archaeological sites. Firstly, it is clear that this period was relatively dynamic. Documented changes include significant increases in the deposition rates of stone artefacts and food refuse, the advent of new tool types (including fish hooks), and site types (e.g. earth mounds), the use of new plant foods (including systematic seed grinding in the arid zone and techniques for detoxifying poisonous plants in central and north Queensland and beyond) and possibly also the beginnings or intensification of complex installations to increase productive yields in some parts of Australia (e.g. inland river eel-traps, coastal fish traps). Offshore islands also begin to be systematically and more intensively used at this time. In some areas (e.g. the Sydney Basin), there is evidence for significant increases in the degree of firing practices across the landscape. Together, these innovations and amplifications of existing features suggest an expansion of settlement and exploitation strategies, including: 1, a more intensive use of 'marginal' environments; 2, an 'intensification' of landscape management practices; and 3, a broadening of resource bases during the mid to late Holocene. These changes also imply an increase in occupational intensities, which may or may not signify absolute population increases.

Secondly, the nature of the changes which took place appears to have varied regionally, begging the question of whether a single, systemic remodelling of socio-economic networks was indicated, or whether the various, largely regional, changes were somehow independent of each other.

And thirdly, an important aspect of this pattern appears to have been a continuing increase in the use of some regional landscapes (e.g. south-western Victoria), and an apparent decrease in others (e.g. Central Queensland Highlands) during the last 2,000 years or so.

An important conclusion which can also be reached in regard to southeast Cape York Peninsula is that there are, at this stage, no obvious spatio-temporal trends in the changes observed. The documented trends do not first appear in one part of the study region and spread, in time, to other areas. Rather, the changes appear in an ad hoc fashion. We would argue that the differences in the timing of cultural changes between sites are due to issues related to sampling, as it is unlikely that each excavation has sampled every material aspect of ancient social life. Rather, social life involves a broad range of practices, only a few of which will be represented archaeologically at any given place and time.

In the past, archaeologists have tended to treat the mid to late Holocene as a time when new things began to happen. Yet it is perhaps equally a time when established conventions continued to occur (a point initially made by Mulvaney & Joyce [1965]). For example, life at Princess Charlotte Bay c.1,700BP cannot be solely characterised by reference to mounded shell middens, even though such mounds became an important aspect of the archaeological record. To understand the new, patterned behaviours, we must also consider how they articulate with existing practices. It is by addressing this issue, it is argued here, that we may better understand the non-synchronicity of the changes observed within and between sites in southeast Cape York Peninsula.

These conclusions apply to all of the changes outlined above. For instance, the first appearance of burren adzes at various times in various sites and subregions is affected by the vagaries of depositional behaviour, and cannot be taken as necessarily marking the time of their original use in those areas. Hence, at Mushroom Rock they appear around 3,000BP, while at Echidna's Rest they appear 2,300 years later. Until we have more data, we cannot say that burren adzes began to be made and used by the inhabitants of those two sites precisely at those times, because it is extremely unlikely that burren adzes will have been carried around, manufactured, used and deposited precisely at the same time that they first appear where the excavations took place. Hence, we would further argue that while general trends can be established, the vagaries of the available

archaeological evidence do not allow the creation of fine grained models of past social practices. By their very nature, archaeological temporalities are coarse grained, and this should be kept in mind when modelling temporal trends in prehistory.

CONCLUSION

Many changes have been observed in the mid to late Holocene archaeological records of eastern Australia. These changes are unlikely to have been independent of each other, leading us to think that social structural forces may have been involved.

We argue that territorial and structural concerns may furnish us with valuable data with which to understand the nature of alterations of past socio-cultural strategies. Unlike the specific changes expressed in stone tool typologies, rates of discard and so forth, structural changes relate to the organisational principles structuring the social systems themselves. These principles usually affect a number of specific social practices, and can therefore be treated as being relatively broad in scope. By investigating structural dynamics, we may thus be in a better position to understand patterns of change and stability in the archaeological record.

The sites excavated in southeast Cape York Peninsula form parts of such systems. The fact that the major changes in settlement patterns, subsistence practices, stone artefact technologies, and so forth all take place during a relatively short period of time hints that they may be expressions of systemic changes, rather than pertaining exclusively to a narrower range of behaviours. The excavations presented in the pre-

vious chapters have only begun to unravel this broader picture.

An important issue thus remains largely unexplored, although it is embedded within many of the observations and interpretations discussed above: while general increases in occupational intensities are apparent, what do they entail? Are we seeing the beginnings of new strategies set within established, regional social networks, or are we seeing a re-structuring of those very networks? Did people do more of the same within any given region, and begin to use sites differently and produce more food, or was there a reorganisation of social life, involving shifts in patterns of intra and interregional relations? In short, did the documented changes in settlement systems also involve changes in territorial behaviour and in the structure of territorial networks?

To date, late Holocene changes have largely been characterised in terms of an intensification of social and economic activity; by the appearance of new resource management strategies, new technologies, and by an increase in the intensities of pre-existing activities sometime, or at various times, during the mid to late Holocene. It is now time to address questions relating to the structure of past human behaviour. We will do this in the following sections by investigating the distribution of rock art conventions through space and time. In so doing, we will attempt to identify the dynamics of subregional networks in the context of broader interregional frameworks — that is, the relationship between the various subregions in the regional systems. We now turn to these issues and to our own interpretations of the patterns and changes documented above.

INTER-REGIONAL STRUCTURE IN THE ROCK ART OF SOUTHEAST CAPE YORK PENINSULA

The task set in the following sections is to investigate spatio-temporal trends in the rock art of northeastern Australia. However, it is not so much the spatial distribution of particular artistic conventions that is at stake, but how the spatial distributions of rock art assemblages have changed through time (that is, the data are set in a diachronic framework).

Because such conventions imply recurrent social practices, they also imply some degree of normative behaviour; in this sense, we are looking at aspects of past socio-cultural systems. In choosing rock art

as a heuristic device for analysing the dynamics of (interregional) social structure in north Queensland prehistory, it is recognised that a number of socio-geographical factors may have affected the distribution of artistic conventions through space. These factors may have little or no relationship to the interregional structure of other material items. This is because of the complexity of structural differentiation, which may involve various social sets and multiple levels of differentiation. For instance, the patterning of stone axes in southeastern Australia, as described by Mc-

Bryde, may reflect relations of exchange structured along circumscribed principals of exclusion, whereas the distribution of, for example, painted motifs in Arnhem Land bark paintings may relate to different social processes (such as the artist's moiety or lineage affiliation) (e.g. Morphy, 1977; Taylor, 1987). Consequently, the distribution of one set of material objects need not coincide with that of another, even if both sets occur in the same region. Nevertheless, as we accumulate information on the distribution of material behaviours across space and through time, it is anticipated that some recurrent distributions will emerge. In such cases, where the distributions of various material items coincide, recurrent spatial discontinuities (major 'boundaries') may be identified. As these data accumulate, so will our understanding of material behaviour across space. Such spatial patterns can be used diachronically as an index to change and continuity in the spatial structure of human behaviour through time. It is the dynamics of such structures that are investigated here.

METHODOLOGY

Although we have chosen rock art to address issues related to the structure of social behaviour during prehistory, we do not see it as possessing any inherent trait that distinguishes it from any other form of material behaviour, except perhaps that it may be particularly amenable to stylistic manipulation because of its considerable plasticity. It may therefore be more sensitive to socio-cultural trends than are, for instance, stone artefacts. The reasons for this are simple and directly relate to the malleability of pigments (in the case of paintings), and therefore to the fact that created items (e.g. paintings) largely reflect the creative tendencies of the artists, tendencies mediated by socio-cultural convention. In contrast, although stone artefacts are also shaped by such conventions, their stylistic manipulation may be relatively more circumscribed by the particular nature of the raw material and by the fact that the shapes of stone artefacts are also mediated by mechanical constraints imposed by their intended functions (but see Sackett, 1982).

FIELD AND RECORDING METHODS

In looking for structure in the archaeological record of north Queensland, we will investigate the geographical distribution of particular artistic conventions through space and time. We begin by describing the rock art of each of the 19 sub-

regions of southeast Cape York Peninsula where rock art has been adequately recorded. In some cases, these recordings were undertaken by us (Table 31), while in others they had been previously recorded by other researchers (Table 32). Only where the rock art has been recorded in a systematic fashion will the latter be presented. Selective recordings, such as Trezise's (pers. comm. 1991) pre-1970 recordings of selected rock art motifs from rock art sites around Laura, are omitted from this work. That is, only data which come from sites where total counts of rock pictures were undertaken, have been used here.

Our own fieldwork involved extensive surveys in a number of areas that had not previously been surveyed. These include Jackass Station (in the Laura sandstones), Bonny Glen Station, the Palmer River limestones, the Mitchell River limestones, Ngarrabullgan, Rookwood Station, Mungana, Chillagoe and Ootan. Additional to this were surveys undertaken in the Cardross sandstones, to the southwest of Chillagoe, and in the Featherbed Ranges, between Ngarrabullgan and Chillagoe. Only three sites and four rock pictures, however, were discovered from Cardross and the Featherbeds.

Our field surveys were undertaken in the following fashion. Areas to be surveyed were selected from aerial photographs and topographic maps or through the knowledge of local informants, and all parts of those areas were surveyed for rock art sites. In all cases, surveys employed a non-stratified, non-random approach. Every identified rock art site was recorded from an identified area, irrespective of the number of rock pictures in them. In most cases, the rock art was sketched onto graph paper (approximately to scale), and notes were taken on the colours used and on superimpositions. The only exception was Jackass Station, where superimpositions, motifs depicted, colours used and the frequencies of linear, infilled and internally decorated pictures were listed, rather than drawn onto graph paper. Much of the art was also photographed. Extensive information was also recorded on each site, including information not used in this monograph, such as the composition of pictures on rock walls and conservation issues. A glossary of terms used in this section is presented in Appendix A.

The rock art recorded by others has so far focused on Princess Charlotte Bay and the Flinders Island Group, the Koolburra Plateau, Laura, Mt Windsor, Mt Carbine and Bare Hill. The researchers who have reported on these sub-regions are too numerous to mention here, and

have been discussed in detail in their appropriate sub-regional settings in the following pages. Recording methods varied considerably between researchers, and these have likewise been described below.

In the above cases, we have taken the raw data mainly from already published lists (e.g. Flood, 1987). In one case (Princess Charlotte Bay and the Flinders Island Group), however, we were able to fully analyse the rock art from Walsh's original recordings, held at the Department of Environment and Heritage office in Brisbane. It is assumed that the various recording methods used by the different researchers will not affect our comparative analyses. These field methods have not always been identical, and have included sketches of the art on graph paper, photographic records, and motif lists. The latter are the most problematic, as in some cases we were not able to ensure that the designation of motif forms was consistent with our own identifications (this was especially apparent for the Laura art). We therefore assume that such designations are used fairly consistently by field workers (e.g. the criteria by which macropods have been identified are similar). Given that most figurative designs are relatively naturalistic in style, their attribution to particular (usually faunal) categories would usually not be controversial.

PRESENTING AND ANALYSING THE DATA

Following a detailed description of the rock art of each subregion, the art will be compared and contrasted spatially via a series of multivariate analyses. Throughout this work, the rock pictures recorded from a particular subregion are assumed to be representative of that subregion. Within each of the areas reported, a number of rock art sites have been identified. In identifying the criteria for comparing the different subregional sets, a number of critical factors have to be taken into account. The first of these is that the art compared has to be contemporaneous. This necessitates some understanding of the antiquity of the rock art studied. This is critical, especially given that the focus of this work is an investigation of spatio-temporal dynamics in southeast Cape York Peninsula. As is well known, however, rock art is notoriously difficult to date. As a result, we have attempted to construct a chronological framework based on direct as well as on indirect evidence.

Secondly, it is important that the different bodies of rock art compared from each region relate to similar techniques, as each technique

may have different characteristics by which the artist may have been constrained. For example, the shape of a stencil is largely circumscribed by the shape of the stencilled object, such as a hand. As Maynard (1977: 393) noted, '*... there is a basic difference between a figure which is delineated on the surface by the artist, and an object which is represented by the mechanical processes of stencilling and imprinting*'. Consequently, it may not be appropriate to directly compare painted pictures, which are the products of freehand designs relatively (but not totally) unaffected by physically-imposed forms, with stencilled ones. Before undertaking a spatial analysis of rock art, we will therefore describe each area's motifs by the techniques employed (see Appendix A for definitions).

The Variables. It is recognised that an analysis of the nature and mode of use of design elements, such as cross-hatching, striping and so forth, may be highly useful to the type of research undertaken here (e.g. C. Smith, 1989). Because of a general lack of appropriate data from all areas except for our own recordings, however, this was not possible. Similarly, it is also recognised that the way pictures are arranged on rock surfaces (their composition) may be indicative of socio-cultural practice, and therefore appropriate to the current analysis, but again this was not attempted because few of the previous recordings from any part of north Queensland had included the necessary details (the only two exceptions being David, 1992d and Faulstich, 1986).

In comparing the rock art of each subregion, absolute numbers are not treated as meaningful indicators of inter-regional variation, as sample sizes vary. In some areas, the numbers of pictures recorded number in the thousands, whereas in other areas, less than 100 pictures have been recorded. Consequently, the following comparative analysis is based on proportions of pictures, calculated as percentages.

The rock art compared herein focuses, by necessity, on the conventions which have been systematically recorded by the majority of researchers, so that a large data base can be used in the analyses. Fortunately, a number of characteristics, such as outlining, infilling, and the presence of internal decorations, have been widely reported from the region, enabling the establishment of a considerable database. The variables which we have decided to use in the following analyses are: 1, colours of paintings and drawings; 2, general motif forms (figurative, non-figurative and track designs); 3, specific

motif forms (e.g. identification of faunal motifs); 4, conventions of linearity of design, outlining, infilling and internal decoration; and 5, the employment of monochrome, bichrome or polychrome paintings and drawings. Variables 2 and 3 are analysed for engravings. Once these variables have been quantified for each subregion, the statistical relationship of the subregions will be investigated for different periods of time. This will be done by subjecting the data to Cluster Analysis and Multi-Dimensional Scaling.

Discussion Of Variables. One of the variables used is the colour of the pigment art. This requires some discussion as colours used are subject to the availability of pigments, which may differ between areas because of differences in geological settings. The patterning of colours obtained from the analysis may therefore be more a function of a region's geology than of particular artistic conventions. Nevertheless, an investigation of colours used through space and time may reveal significant trends, transcending the natural distributions of raw materials. This may be especially so if ochres of particular colours have been traded over wide areas, resulting in their spread into areas where they do not occur naturally. In such cases, the distribution of painted colours through space may offer a useful means of investigating the nature of prehistoric exchange networks. Although this issue will at times be addressed, it will not form an important part of the following analysis.

In some of the analyses we have also resorted to a practice which we had hoped to avoid: the separation of the rock art into figurative, track and non-figurative forms. Ideally, we should not begin by assuming qualitative differences between figurative and non-figurative motifs, as both relate to pictorial behaviour. Figurative and non-figurative designs are not inherently different from each other, as they are both signifiers of socio-cultural constructs, and in both cases the forms employed can be treated as metaphors for other things (Frost et al., 1992; David & Flood, 1991; but see Munn, 1973). In investigating spatio-temporal conventions, a more appropriate investigation would thus be, for example, to identify differences and similarities in the ways specific forms are composed on rock surfaces, rather than simply separating pictures into the broad categories of figurative and non-figurative.

Nevertheless, non-figurative and figurative images have been differentiated in some of the tests undertaken here, because the two are qualitatively different formal conventions — figurative designs

are immediately recognisable by most observers to have formal similarities to specific objects, whereas non-figurative ones are not. While we have retained this formal distinction in the following chapters, however, not all of the inter-regional comparisons made will depend on it. The figurative/non-figurative distinction was made possible here because pictures were differentiated thus for all of the areas reported by previous authors, enabling a comparative analysis of pictures from the different areas.

THE ROCK ART

The rock art of southeast Cape York Peninsula was amongst the earliest to be reported by European explorers in Australia. In 1821, Allan Cunningham observed cave paintings on remote Clack Island during Captain King's marine surveys of the Australian coast (King, 1837). He noted: '... a horizontal stratum of black schistose rock ... upon the roof and sides of which some curious drawings were observed. ... They represented tolerable figures of sharks, porpoises, turtles, lizards... trepang, starfish, clubs, canoes, water-gourds, and some quadrupeds.' (King, 1837: 25-6).

Eighty years later, Roth (1902, 1904) reported the same paintings recorded by Cunningham, as well as others on the adjacent mainland. He noted that '... rock paintings are met with in many districts throughout north Queensland, and were systematic research to be made would probably be found to be of more common occurrence than is usually supposed' (Roth, 1902: 12).

More recently, Roth's conviction has been borne-out by the works of Robert Logan Jack (1895), Hale & Tindale (1933-4), Seaton (n.d.), Trezise (1971, 1973, 1977), Woolston & Trezise (1969), Rosenfeld (1982, 1984; Rosenfeld et al., 1981), Flood (1987; Flood & Horsfall, 1986), Clegg (1978), Clegg & Fethney (1988), Maynard (1979), Cole (1988) and Walsh (1986; 1988). These authors have all commented on the rock art of southeastern Cape York Peninsula, and this has resulted in the formation of a vast data base, including quantitative data on the rock art of numerous parts of southeastern Cape York Peninsula. Coupled with the work of Morwood (1985, pers. comm., 1990) and Border (pers. comm., 1990) in northwestern Queensland, our knowledge of north Queensland's rock art was thus relatively extensive by the time this study began.

In spite of this, the rock art from large sections of the study region remained totally unknown

when we first began this research. If past inter-regional networks were to be investigated via a comparative analysis of rock art, it was important to have relatively fine-grained spatial data to enable the investigation of continuities and discontinuities across the region. In other words, it was important that the available database consist not only of rock art from discrete and spatially separate sub-regions, but also from continuous stretches of land spanning considerable distances. This was deemed important for a proper characterisation of the change-over of particular conventions between subregions.

Because of these issues, it was necessary to undertake surveys and systematically record samples of rock art from a number of subregions before analysis could begin. It was deemed important that these subregional sets link-up with previously recorded areas across a broad geographical field. The surveyed areas included ten subregions previously studied by other researchers, and ten areas from which rock art was recorded by us (Tables 31, 32; note that Bare Hill was recorded in both cases).

THE ROCK ART OF PRINCESS CHARLOTTE BAY AND THE FLINDERS ISLAND GROUP²

The rock art of Clack Island, the northern-most island of the Flinders Island group, is amongst the earliest to have been described by European explorers in Australia (Coppinger, 1883; King, 1837: 27; Meston, 1895; Stokes, 1846). Although these descriptions were brief, they were followed by a series of scientific expeditions, culminating with Hale & Tindale's (1933) work during the first half of this century, and ending with Walsh's (1985) surveys in the 1980s (see also Negerevich, 1979; Sutton et al., 1975).

During his surveys, Walsh systematically recorded all of the known rock art sites from the Flinders Island group, as well as a sample from the mainland. His recordings were, for the most part, total recordings of all pictures from each site, although in some sites only a selection of pictures were recorded. The latter have been omitted from the following analyses. Furthermore, while Walsh documents the numbers of colours used in each picture, no systematic data were presented on the specific colours used. Consequently, the following analyses are restricted to

formal attributes, and to the numbers of colours used (monochrome, bichrome or polychrome). No engravings were recorded from any site, and all the pictures were either paintings, drawings or hand stencils.

Walsh's recording forms have been lodged with the Queensland Department of Environment and Heritage (DEH), Cultural Heritage Division, Brisbane. We have constructed all of the following tables from the original recording forms. It is from this data-base that the rock art of Princess Charlotte Bay and the Flinders Island group is analysed herein.

For analytical purposes, we have subdivided the subregion into five smaller geographical sets (Fig. 39):

- 1, Clack Island;
- 2, Cliff Island, located near the western extremity of the Flinders Island group,
- 3, Flinders, Stanley, Denham Islands and Rocky Islet, being the main cluster of islands forming the Flinders Island group (referred to as the Flinders Islands);
- 4, the Bathurst Range, being the range of low sandstone hills delimiting the eastern edge of Princess Charlotte Bay; and
- 5, Jane Table Hill, consisting of an isolated sandstone outcrop located towards the southern end of Princess Charlotte Bay.

In addition, two rock art sites were recorded from Cape Melville, to the east of the Bathurst Range (one painting was identified from each site), and one site (with nine paintings) was recorded from Howick Island, located approximately 60km southeast of Princess Charlotte Bay (and immediately southeast of Cape Melville). In all cases, the parent rock was sandstone.

CLACK ISLAND

Of the twelve sites located on Clack Island, only nine were systematically recorded (the art from Walsh's site numbers 8842, 8843 and 8851 was only partly recorded and has therefore been omitted from the following analysis). All of the rock art consisted of paintings.

MOTIF FORMS

Numerically, two motif forms dominate the Clack Island paintings: zoomorphs with crescent heads, and moth/butterfly designs. Together, they account for 284 (67.0%) of the 424 paintings from the island. A significant number of marine zoomorphs, including stingray, squid/octopus,

² At the request of traditional owners, photographs of the rock art have not been included in this section.

fish, crustacean, turtle and dugong/shark motifs are also present. A small number of paintings of other (mainly terrestrial) fauna and anthropomorphs also occur (6.4%). Macropod and bird tracks are uncommon (3.3%), as are items of material culture (a boat, stone axes, woomeras and spears) (2.6%) and non-figurative designs (lines, crescents, asterisks, circles and ovals, many of which are barred) (5.9%) (Table 33).

OTHER CONVENTIONS

The colours used and the numbers of outlined, infilled and internally decorated paintings have not been reported. Nevertheless, the practice of white dotted outlining was recorded by Walsh, who noted that 63 (14.9%) of the Clack Island paintings possessed this trait. Although it is not known whether or not these paintings also contain infilling or other decorative elements, it indicates the repeated use of a highly idiosyncratic convention in the area (see below).

The Clack Island paintings are mainly monochrome (83.2% of paintings), although a significant proportion of bichromes are also present (16.8%) (most of Walsh's slides are of red and/or white paintings). No paintings have been recorded in more than two colours.

CLIFF ISLAND

Cliff Island is located near the western extremity of Princess Charlotte Bay. Only two sites and 47 paintings have been recorded from the island. Table 34 lists the motif types, highlighting again a predominance of zoomorphs with crescent heads and moth paintings in a rock art assemblage containing significant proportions of marine fauna. All of the paintings from Cliff Island are monochrome, and no dotted outlined designs have been observed.

THE FLINDERS ISLANDS

Twenty-two rock art sites have been recorded from Flinders, Stanley and Denham Islands and Rocky Islet. Ten of these are located on Flinders Island.

MOTIF FORMS

A total of 669 pictures, consisting of 618 paintings and 51 hand stencils, were recorded by Walsh. As was the case at Clack and Cliff Islands, paintings of zoomorphs with crescent heads and moth/butterfly designs predominate (43.4% of paintings), with images of marine fauna also

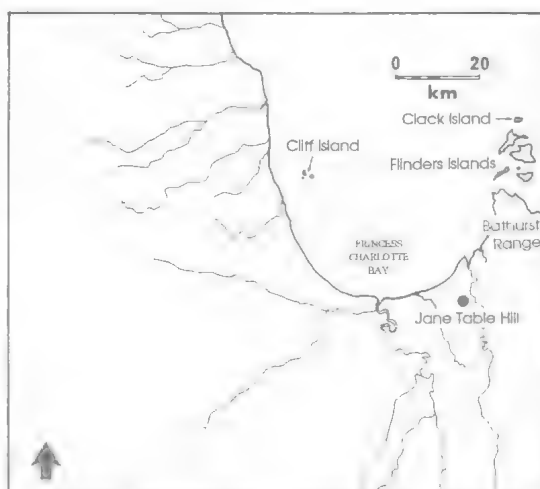


FIG. 39. Princess Charlotte Bay and the Flinders Island group, showing the location of the five localities used in this analysis.

being common (16.7%) (Table 35). The range of motif forms is similar to those from Clack and Cliff islands, pointing to a widespread artistic tradition in the islands. Although present, paintings of animal tracks (including a human track), items of material culture and non-figurative designs are uncommon. This is despite the fact that in some sites (especially sites 8834 and 8836), boats are very common.

OTHER CONVENTIONS

The paintings of the Flinders Islands were painted both in monochrome and in bichrome, and again no polychrome designs were recorded. A significant proportion of paintings contained white-dotted outlines (176 paintings, or 16.2%), although again the use of colours has not been systematically reported.

BATHURST RANGE

The Bathurst Range borders Princess Charlotte Bay along its eastern margins. It consists of low sandstone hills which become submerged to the north and west, only to re-emerge in the islands of the Flinders group.

Only five rock art sites, and 173 paintings and 24 hand stencils, were systematically recorded by Walsh along the Bathurst Range. As was the case for the islands, a number of paintings have a white-dotted outline (eight paintings, or 4.4%). Unlike the rock art from some of the islands, however, the majority of paintings in the Bathurst

Range were painted in bichrome (87.0%). All other paintings are in monochrome.

The major motif types documented from the Bathurst Range are similar to those from the islands. Zoomorphs with crescent heads and moth/butterfly motifs are numerically dominant (54.9% of paintings), while marine fauna are also important (15.6%). As was the case in the nearby islands, other fauna contribute a minor but important proportion of paintings (8.7%), while animal tracks (9.8%), items of material culture (6.4%) and non-figurative designs (4.6%) are all uncommon (Table 36).

JANE TABLE HILL

Situated towards the southeastern corner of Princess Charlotte Bay, Jane Table Hill is an impressive, isolated sandstone outcrop visible from some distance away. Nineteen rock art sites have been recorded here, containing 378 paintings and nine hand stencils. As was the case on the Bathurst Range to the immediate north, and on the islands nearby, the practice of white-dotted outlining occurs, although it is slightly less common here than elsewhere in the area (1.6% of paintings). Most of the paintings from Jane Table Hill are monochrome (71.9%), and the rest are bichrome.

The range of motif forms represented is similar to that found elsewhere in Princess Charlotte Bay and the Flinders Island group. Zoomorphs with crescent heads and moth/butterfly motifs are again numerically dominant, accounting for 68.3% of the paintings. Marine fauna continue to occur (5.3%), although here they are not as common as on the islands or at Bathurst Range. Other zoomorphs are also present (3.7% of paintings), as are animal tracks (8.7%), items of material culture (4.5%) and non-figurative designs (9.5%) (Table 37). As was the case at Clack Island, barred circles/ovals form an important component of the non-figurative art.

DISCUSSION

The rock art of Clack Island, Cliff Island, the Flinders Islands, Bathurst Range and Jane Table Hill represent a homogeneous body of cave art, consisting almost exclusively of paintings. While some hand stencils have been recorded, no other rock art technique has yet been observed from the area.

In each of the five areas surveyed, the paintings are dominated by figurative forms lacking com-

plex internal details. In many cases, the identification of specific faunal categories and of items of material culture is made possible by the presence of a small number of external elaborations on otherwise generalised body shapes, such as claws on crabs and masts on ships.

By far the most common motifs in each of the localities studied are zoomorphs with crescent heads and moths/butterflies. Perhaps this, more than anything else, best characterises the art of Princess Charlotte Bay and the Flinders Island group. Paintings of marine fauna are also common, as is the practice of white-dotted outlining. The presence of these conventions in most parts of Princess Charlotte Bay and the Flinders Island group indicates a widespread set of conventions characteristic of this subregion.

Within this general, homogeneous pattern, however, minor differences also occur, although it is difficult to determine whether or not these are significant given the small numbers of paintings found in each area. Foremost among these is an apparent greater emphasis on marine elements in the rock art of the islands, and this is especially evident in the very high numbers of boats recorded in the Flinders Islands and their rarity on the mainland (and total absence from Jane Table Hill). This difference is also reflected in differences in the proportions of marine fauna, which peak on Cliff Island (21.3%) and achieve their lowest level at Jane Table Hill (5.3% of paintings). It may be significant to note that, of the 3 rock art sites and 11 paintings recorded to the immediate east (Cape Melville) and southeast (Howick Island) of the study region, none of the main motif forms from Princess Charlotte Bay and the Flinders Island group were observed (moths/butterflies and zoomorphs with crescent heads). Instead, the recorded paintings consisted of one turtle, one snake and nine anthropomorphs, a motif break-down more reminiscent of the art of the Laura and Mitchell-Palmer subregions to the south than of Princess Charlotte Bay and the Flinders Island group (see below). Obviously, the sample size here is very small, but given the great preponderance of zoomorphs with crescent heads and moth/butterfly motifs in all parts of Princess Charlotte Bay and the Flinders Island group, and the importance of marine fauna and boats, their absence from the sites recorded at Cape Melville and Howick Island may be significant.

ANTIQUITY OF THE ART

Very little is known about the antiquity of the rock art. The evidence is slender and largely circumstantial, as no direct dates have yet been obtained from any painting or stencil.

Ethnographic Observations. At Bathurst Head, Hale & Tindale (1933: 135, 155) observed a man painting or stencilling hands in a rockshelter earlier this century. They reported that rock art had great significance to the Walmbaria Aborigines of Flinders Island, and a person could cause harm to another by painting their image on the rock (Hale & Tindale, 1933: 91). Specific motifs were identified (e.g. turtles, dugongs, etc.), including the identification of moth/butterfly motifs as *motjala* (moth/butterfly) by local people. The origins of some pictures, however, were beyond the memory of the people with whom Hale & Tindale (1933, 1934) conversed, which may imply an antiquity preceding the twentieth century AD. It appears that the rock art was not just prehistoric in nature, but formed part of the contemporary cultural landscape, even though some local people had no knowledge of the origins of some paintings.

Sailing Ships and Steel Axes. At least some of the art dates to post-contact times. This is evident from paintings of a steel axe and sailing ships in a number of sites. The latter are especially significant given their large numbers in some sites, especially on the islands. The ships appear to be mainly of European design, and therefore probably date to the last 350 years or so. No confirmed praus (Macassan boats) have been identified, although many of the painted ships are generalised in shape. At least one ship has painted letters on its side (the letters NT).

Dingoes. As dingoes arrived in Australia sometime between 4,000 and 3,500 years ago, it is possible to say that paintings of dogs date to the late Holocene. Although they are not particularly abundant, 14 paintings resembling dogs have been recorded from seven sites on Clack Island, the Flinders Islands and Bathurst Range. Their stylistic attributes (especially line work and generalised body shapes) situate them within the same broad style as other figurative images from the area; that is, dogs do not stand out as having been painted by conventions different to those applied in other paintings from the area. This suggests that they were probably painted within an artistic tradition which included most, if not all, of the figurative paintings of the area.

White Pigments. Many of the paintings and stencils of the area were undertaken in white pigment (kaolinite). Such pigments are known to

be unstable, being subject to flaking off rock surfaces, especially when exposed to dynamic environmental conditions (e.g. wind) (e.g. Bednarik, 1994; Flood, 1987; Rosenfeld, 1988b). Many of the rock art sites, and especially those on the islands, are exposed to oceanic winds (Fig 40). Although Walsh does not quantify the colours used in the art, white paintings are noted to be relatively common, occurring in monochrome and bichrome designs. The presence of white-dotted outlines has already been noted. The relatively common occurrence of paintings undertaken in an unstable pigment thus implies that much of the rock art is unlikely to be very old. This is especially so given the coastal and offshore context of the art, where salts and offshore winds can be expected to have affected the paintings. These factors indicate that the white pigment art almost certainly dates to the late Holocene period.

Excavations and Occupational Trends. None of the painted and stencilled rockshelters show any evidence for a long occupational history. Most sites possess little to no evidence of occupation, and of those that contain occupational deposits, the deepest sequence (Walaemini Rockshelter) is no more than 4,700 years old (despite extensive surveys for potentially deep sites). The excavations at Alkaline Hill and Endaen Rockshelter have even more recent deposits. In addition, occupational intensities, as measured by the numbers of shell middens from the region, begin to show significant increases after around 1,700BP. Within a broader context of occupation, the rock paintings of the Princess Charlotte Bay and Flinders Island group are therefore unlikely to pre-date 4,700BP, given a total absence of evidence for earlier occupation in the area. Unfortunately, however, Beaton (1985) did not report on the occurrence of pigments from the sites he excavated. Indeed, the majority of paintings and stencils are probably more recent than the above dates, given that most of the known sites appear to be more recent in age.

CONCLUSION

The predominant motif forms at Princess Charlotte Bay and the Flinders Island group are paintings of moths/butterflies and zoomorphs with crescent heads. A significant proportion of paintings from all parts of the area have a marine theme, such as dugongs/sharks, stingrays and sailing ships. There appears to be great homogeneity in the relative proportions of motif forms across space, although within this general trend there is



FIG 40. Example of rock art sites exposed to maritime winds, Clack Island. Numerous rock paintings occur near sea level here (Photograph by G. Walsh).

also evidence for decreased proportions of marine-oriented paintings along the mainland sections surveyed (Jane Table Hill and the Bathurst Range).

The rock art of Princess Charlotte Bay and the Flinders Island group consists of paintings and engravings which probably date to the late Holocene. Although the antiquity of the earliest images is uncertain, painting and stencilling continued until the twentieth century. It is unlikely that any of the paintings pre-date the mid Holocene.

THE ROCK ART OF THE KOOLBURRA PLATEAU

The Koolburra Plateau is 45km², incorporating deep gorges, cliff-lines and terrain covered with large sandstone boulders. Four sections of the plateau were surveyed for rock art sites by Flood in 1981-2, including one in the north, two in the centre and one in the south (Flood, 1987: 92). In Flood's own words, *'The northernmost area, which contained many large boulders and some small cliffs, was that from the tip of the plateau to the northern side of Boomerang Creek, in the vicinity of the excavated site of Green Ant 1. Moving*

southwards, the next area to be surveyed was the Echidna Creek Valley, containing the other excavated site, Echidna Shelter. ... The Echidna Creek Valley was chosen for this survey because of its relatively small and well-defined catchment, which is only about 8 square kilometres.

... A major creek system in the centre of the plateau is Black Dog Creek. Here forty art sites were recorded in the lower and middle reaches of the creek; because of the time needed to record a group of major sites discovered there, no time was available to explore the uppermost reaches. At the southern end of the plateau the south-west tip was chosen for exploration because of its proximity to the riverine environmental zone of the Kennedy River. This area yielded nineteen art sites, and three others were recorded in the south-east of the plateau including a major gallery, Ancient Dreaming ..., in a large cliff which was pinpointed from aerial reconnaissance by Percy Trezise' (Flood, 1987: 92-94).

Some 163 rock art sites and 2,578 determinate pictures were recorded from these four zones. Of these sites, 96.3% contained stencils, and in 49.7% of cases, stencils were the exclusive mode of decoration (Table 38; Fig. 41). This represents

a major difference to the low proportions of stencils documented from Princess Charlotte Bay and the Flinders Island group to the north.

PAINTINGS

MOTIF FORMS

Flood (1987: 106) noted that anthropomorphs and therianthropes are the most common subjects of the Koolburra paintings (Figs 42-44). Therianthropes are designs consisting of a combination of animal and human traits (Lewis-Williams, 1982). They are usually very rare in Australia, but at Koolburra they appear in relatively large numbers (Table 39). As Flood noted, *'The most numerous painted motifs (disregarding the indeterminate ones) appear to be therianthropes. ... In form they are echidnas, the spiny anteater of Australia which is an egg-laying mammal, but they also have human characteristics such as breasts, a penis or a fringed skirt, and/or supernatural features such as rays on their heads. The male figures tend to have rays emanating from the head like a headdress, and the females have a long split 'snout' or 'nuzzle' and a fringed 'skirt' or pubic 'apron'... No figure with a rayed head wears a string apron, which*

are exclusively associated with rabbit-like or antenna-like type of "headdresses".' (1987: 110-112).

Flood (1987) also notes that therianthropes of this type do not occur in the Laura district to the immediate southeast, a point disputed by Trezise (1987: 124), who noted that *'... there are at least two "Echidna People" in Giant Wallaroo gallery and many more in the Hann River region'*. The Hann River, however, occurs to the west and northwest of the Koolburra Plateau, and the general absence of therianthropes to the east of the Kennedy River remains an intriguing problem. This difference cannot be attributed to a lack of archaeological research at Laura, for it has been far more intensive than on the Koolburra Plateau (e.g. Cole, 1988; David, 1991a; Maynard, 1976; Morwood, 1989a, 1989b; Rosenfeld et al., 1981; Trezise, 1971; 1973). Furthermore, Flood (1987: 114) noted that the therianthropes from Black Dog Creek to the south are more elaborate and contain greater amounts of intricate internal decoration than do those from the central and northern sections of the plateau (Table 40). She concluded that *'... it is probably no coincidence that the figures which are furthest south and thus closest to the Laura painting sites bear the most elaborate internal*



FIG. 41. Hand stencils and paintings, Koolburra Plateau (photograph by J. Flood).

decoration, for this is a characteristic of many of the Laura paintings' (Flood, 1987: 114).

The other common motifs of Koolburra Plateau's rock paintings are anthropomorphs. They account for 22.0% of the paintings, most of which are monochrome infilled and generalised in shape. Other figurative designs include a range of zoomorphs, although, curiously, macropods and macropod tracks have not been observed. This is a feature not only of the Koolburra rock paintings, but of those from the Mitchell-Palmer limestone belt also (see below). Both regions are located on the edge of the Laura area — Quinkan Country — and as such help to define it as a bounded stylistic region. Of interest also is the absence of flying foxes and birds from the art of the Koolburra Plateau, both of which are common in the Laura area nearby.

Non-figurative motifs include spoked concentric circles, enclosed elongated figures with cross-stripping, double arches, comb-like and feather-like designs and globular and elongated figures. Together, they account for 20.8% of paintings, while bird tracks make up a further 12.6%.

OTHER CONVENTIONS

Most of the Koolburra Plateau paintings are monochrome (80.2%), with some bichromes also present (19.8%). No polychrome paintings have been noted (Flood, 1987: 104). Of a sample of 288 paintings from 17 sites, Flood (1987: Table 9) identified monochrome infilled and monochrome linear designs as being numerically dominant, contributing 44.8% and 35.4% of paintings respectively. The other paintings consist of bichrome outlined/infilled pictures, some of which also contain internal decorations such as internal lines or sets of dashes (e.g. Fig. 44) (Flood, 1987, figs 5-7). Monochrome red designs account for 61.1% of paintings, with white contributing 16.7%. Both black and yellow are present but rare (Table 41).

STENCILS

Stencilling is the dominant technique in Koolburra rock art, accounting for 72.4% of the art. Most are hand stencils (98.8%), with boomerangs (1.2%), feet (0.6%), and dilly bags (0.2%) also present. 5.4% of stencilled hands appear as hand variants — that is, fingers or joints of fingers are either missing or were bent during the stencilling process, giving the appearance of mutilated hands. Most stencils were done in red ochre, but white, yellow and orange hand stencils are also present (Flood, 1987: 103).



FIG. 42. Anthropomorph from Echidna Dreaming, Koolburra Plateau (photograph by J. Flood).

ENGRAVINGS

Although Flood (1987, fig. 8) identified 604 engravings, many of these were indeterminate. Of the 259 that were clear enough to be recorded, peckings, poundings and abrasions were identified. Unfortunately, Flood (1987) does not differentiate between these techniques, which diminishes greatly the value of her data for the purposes of this work. Nevertheless, she noted that clear distinctions can be made between more heavily patinated peckings, and what appear to be more recent and unpatinated ones (Flood, 1987: 98; pers. comm., 1990) (Fig. 45). The former consist predominantly of macropod and bird tracks, pits and other non-figurative motifs, whereas the latter include figurative designs as well as non-figurative and track ones. Bird and macropod tracks are the most common forms, accounting for 41.7% of engravings. Small asymmetric circles, pits and sets of circles and pits are the second-most common motifs (29.7%). As

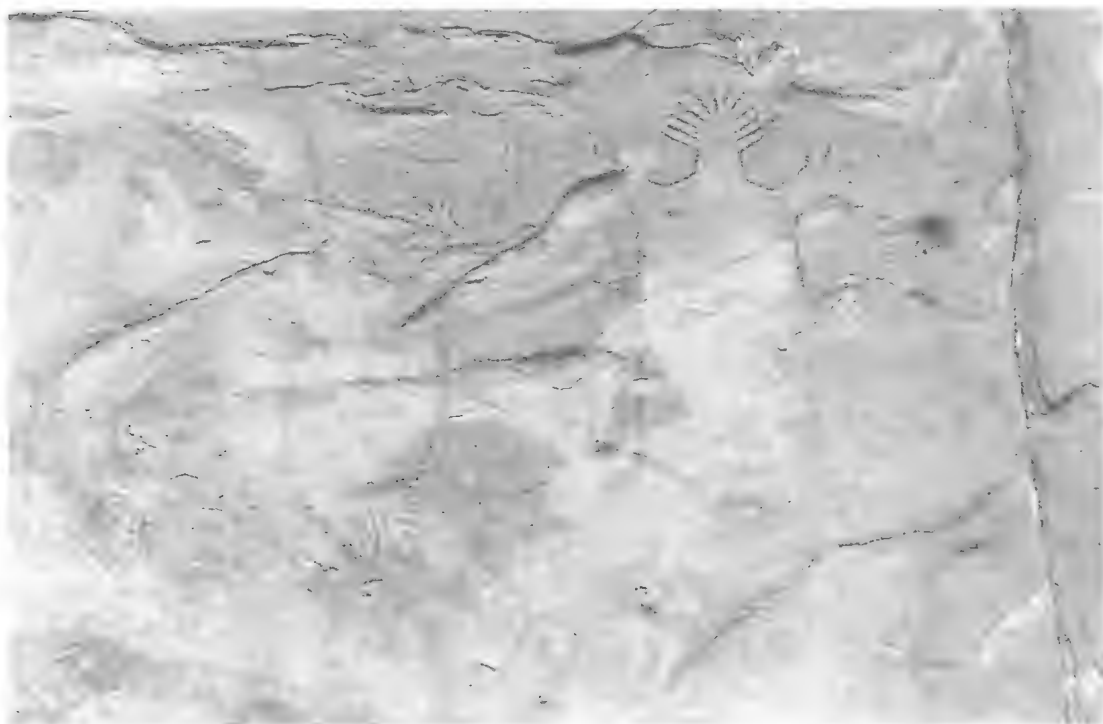


FIG. 43. Therianthropes from the Koolburra Plateau (photograph by J. Flood).

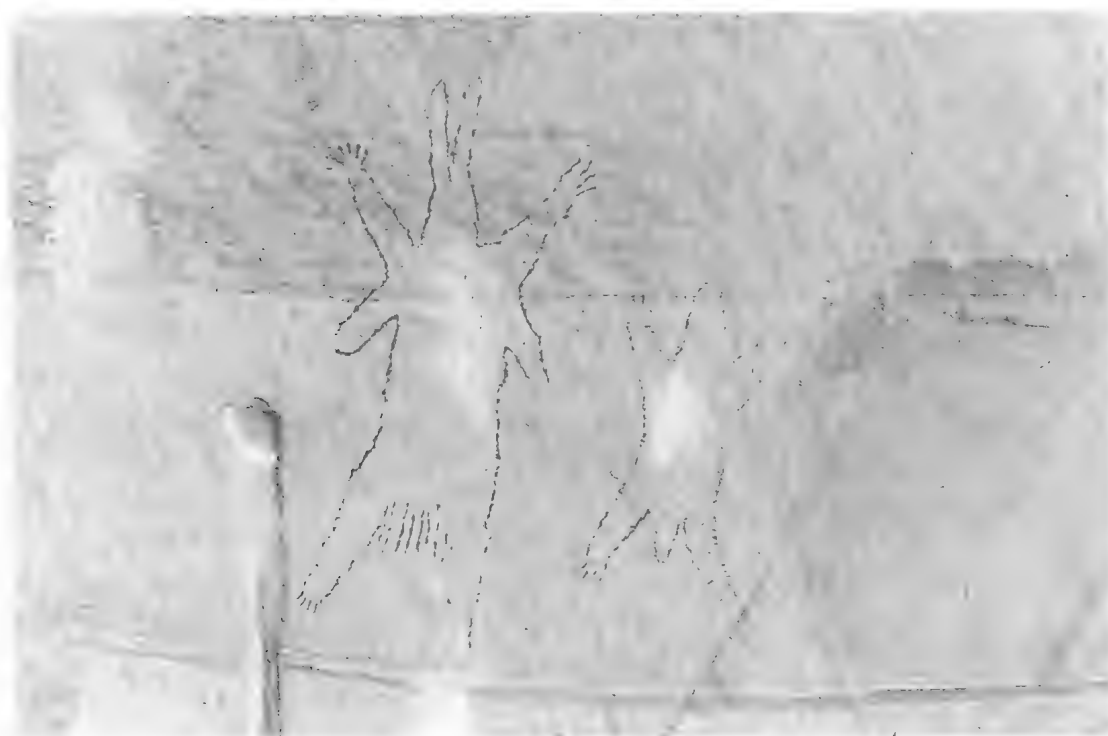


FIG. 44. Therianthropes from Echidna Dreaming, Koolburra Plateau (photograph by J. Flood).

Flood (1987: 100) noted, '*... the body of engravings taken as a whole is dominated by the motif categories termed pits and tracks, but there is also a clear change reflected in the two large sites from a non-figurative to figurative style*'. Hence, although curvilinear mazes, rounded enclosures with grids, pits (both as individuals and in rows), bird tracks and macropod tracks dominate the patinated engravings, figurative designs (excluding tracks) constitute an important component of the non-patinated forms (Table 42).

ANTIQUITY

As at Princess Charlotte Bay and the Flinders Island group, no direct dates exist for the rock art of the Koolburra Plateau. Nevertheless, despite the circumstantial nature of the evidence, a number of observations have enabled the formulation of a broad chronological model for the area.

SUB-SURFACE ENGRAVINGS

Sub-surface engravings were uncovered in the Green Ant Shelter excavations; sediments dated to $1,570 \pm 60$ BP (Beta-3777) lay immediately above a series of deep, patinated pecked pits.

These engravings are therefore older than this date (Flood, 1987: 96).

SUPERIMPOSITIONS

Flood & Horsfall (1986: 26) noted that '*... all the rock paintings at Green Ant Shelter seem fresh and overlie the engravings*' (e.g. Fig. 45). Although the sample size is not large, Flood (1987: 95-96) also notes that while paintings have been noted to occur over engravings, no examples of engravings overlying pigment art have been observed. Furthermore, while on two occasions, unpatinated occur over patinated engravings, the reverse has not been detected. If this pattern is representative of the region as a whole, the implication is that engravings are among the earliest techniques of rock art from the area, and that the engravings may have been created over a considerable period of time.

WEATHERING AND PATINATION

As is noted above, an important distinction is made by Flood (1987) between presumed early, heavily patinated engravings, and later ones with little to no evidence of patination. The former consist entirely of animal tracks and non-figurative

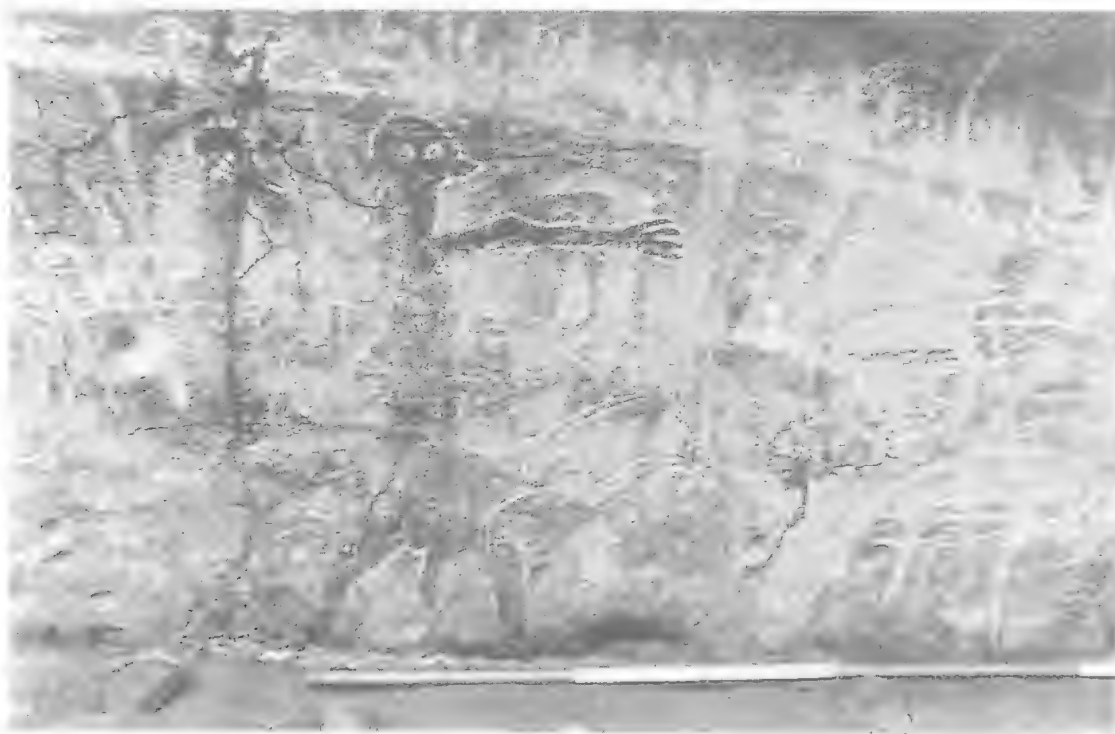


FIG. 45. Unpatinated peckings superimposed by a painting, Green Ant Rockshelter, Koolburra Plateau (photograph by J. Flood).

engravings, whereas the latter are represented by a continuation of earlier motif forms with the addition of some figurative ones.

DINGOES

Although no dogs have been identified among the Koolburra Plateau paintings, three dog tracks were identified among the unpatinated engravings. These peckings probably date to the last 4,000-3,500 years, as dogs first arrived in Australia at this time, and therefore at least some of the unpatinated engravings can be presumed to date to the mid to late Holocene.

WHITE PIGMENTS (KAOLINITE)

Some 32.9% of paintings from the Koolburra Plateau contain white pigments. Given the instability of kaolinite, it is unlikely that these paintings have great antiquity. Motif forms include all of the major figurative elements from the area, including therianthropes. So common are paintings containing white pigments, that a significant proportion of paintings can be said to have a relatively recent antiquity.

STRATIFIED PIGMENTS AND ASSOCIATIONS WITH OCCUPATIONAL DEPOSITS

Both of the excavated rockshelters from the Koolburra Plateau show signs of human occupation beginning sometime during the early Holocene. In both cases, engravings and pigment art are found on the rock walls. At Echidna Shelter, the amounts of stratified ochre were very small, but at Green Ant their numbers increased significantly after c.1,800BP. This implies that, at this site at least, painting activity increased after this time. Given Flood and Horsfall's statement that all superimpositions at Green Ant are of paintings over engravings, many of the latter are likely to pre-date c.1,800BP. Flood (1987; Flood & Horsfall, 1986) also argued that, given that unpatinated engravings never occur underneath patinated ones, and given also the latter's more weathered appearance, the patinated engravings at Green Ant and Echidna Shelters probably date to the earliest levels of occupation at these sites — that is, to the early Holocene.

DISCUSSION

The various lines of evidence generally support each other with respect to the antiquity of the Koolburra Plateau's rock art assemblages. Heavily patinated engravings probably required a con-

siderable amount of time for cortex development to take place, although as Dragovich (e.g. 1981, 1984, 1986, 1987) has noted, this line of argument should be used with caution as it is not as clear-cut as some have made it out to be (e.g. Flood, 1987). In the Koolburra Plateau, these early art forms include macropod and bird tracks, pits and other nonfigurative motifs. Some of these have been found stratified within levels dated to before c.1,500BP at Green Ant.

The less patinated engravings include figurative as well as track and non-figurative motifs. These may be relatively more recent in date. The exact temporal relationship between figurative engravings and paintings is not well established, although patterns of superimposition imply that there has been a change from track and non-figurative, patinated engravings, to a broad suite of figurative, track and non-figurative unpatinated engravings and paintings. However, the sample size is small. Furthermore, it is possible that painting and engraving activity followed different rules of spatial behaviour, so that while engravings and paintings may have been contemporaneous, the former were never created over paintings, whereas paintings could be undertaken over engravings. Because of this uncertainty, we must treat the above scenario with caution.

Excavations at Green Ant and Echidna Shelter have enabled two further statements to be made about the antiquity of pigment art and engravings within these sites: 1, pigment art has been undertaken since the earliest evidence of occupation, although during early times such activities were probably not intensive; and 2, after c.1,800BP, the evidence for the creation of pigment art is extensive. As Flood (1987) notes, there is an explosion of painting and stencilling activity during the late Holocene in the Koolburra Plateau. This pattern is also supported by the significant proportion of paintings created with unstable pigments (white kaolinite), and by the pattern of superimpositions, indicating that paintings are probably relatively recent.

THE ROCK ART OF LAURA

The Laura sandstones contain two superimposed sedimentary formations. The upper unit consists of fine sand in a weak matrix, while the lower emerges as a coarse sandstone consisting of water-laid pebbles, many of which have been

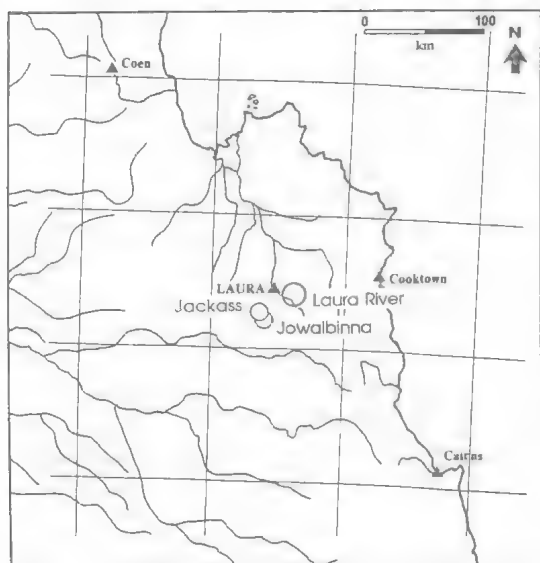


FIG. 46. Location of major fieldwork, Laura sub-regions.

known to produce high quality ferrous oxide nodules suitable for use in rock painting.

European accounts of rock art at Laura were first published in 1895, when Robert Logan Jack, the government geologist, announced the presence of paintings along Chink and Mun Gin Creeks. In 1902, Roth documented paintings near Cooktown and along the Palmer River (Roth, 1902), but systematic recording did not begin until the early 1960s, after a road crew reported the Split Rock galleries. Subsequently, Percy Trezise, a pilot with Bush Pilot Airways, began to systematically investigate the sandstone cliff-faces of the Laura area for rock art sites. Since then, he has recorded hundreds of sites from various parts of the subregion, some of which have been subsequently excavated by professional archaeologists (e.g. Morwood, 1989a, 1989b; Rosenfeld, 1975; Rosenfeld et al., 1981; Wright, 1971).

Although systematic in approach, Trezise's recordings have never been assembled into a unified work (but see Cole, 1988 and Trezise, 1971). In his pre-1970 recordings, Trezise (pers. comm., 1991) was selective about the rock pictures he recorded, omitting certain motifs such as many non-figurative designs. But he later changed his recording techniques, to include all pictures from the sites he documented. In addition to Trezise's work, a number of theses on the rock art of the Laura area have also appeared during the last 20 years or so (e.g. Cole, 1988;

Franklin, 1992; Maynard, 1976), including a detailed analysis of the rock art of one part of southern Laura (the Jowalbinna area) by Cole in 1988.

This section summarises the works of Maynard near the Laura River and our own, limited recordings from Jackass Station to the immediate southwest of the township of Laura (abutting Jowalbinna Station) (Fig. 46). Although Cole's work will be briefly mentioned, no detailed quantitative data will be presented, as these are currently being prepared for publication by Cole (pers. comm. 1995). Suffice it to say here that, as far as our work is concerned, the Jowalbinna material is very similar to that of other parts of Laura.

In the following discussions, we have not used other quantitative data from Laura, as other recordings from the area have either not been systematic, in the sense defined in this work, or because the recordings themselves have not been presented in a way that we can use.

JACKASS STATION

Jackass Station is located 40km east of the Koolburra Plateau, immediately west and southwest of the township of Laura. It consists of a 160km² property west of Olivale and Jowalbinna Stations, and contains relatively flat plains (approximately 200m ASL) in its eastern and northern sectors, rapidly giving way to rugged, dissected hills (200m ASL to 520 ASL) to the south and southwest. A series of permanent and temporary creeks, such as Christmas Creek, Rocky Creek, Pine Tree Creek and Shepherd Creek, flow from the hills onto the more gentle plains. Sandstone cliffs line gorges where creeks intersect the rugged country. It is here that large numbers of rocky overhangs can be found (Fig. 47).

In 1991, one of us (BD) undertook preliminary surveys for rock art sites along Rocky Creek gorge (in the western part of the station) (David, 1991e). In addition to the sites recorded, others have also been observed by local residents, including at least two major sites located during the 1960s by Percy Trezise to the south near Jowalbinna, but these have not been systematically recorded (P. Trezise, pers. comm., 1991).

Although sandstone overhangs were commonly observed along Rocky Creek, only four rock art sites were identified. Because of time constraints, field surveys were terminated after the systematic recording of only two sites. Both con-

tained a large number of paintings, although superimpositions were not recorded. Of the 294 pictures identified, 246 were clear enough for their forms to be determined. The rest were indeterminate.

Paintings and stencils occur in similar proportions at Jackass Station, contributing 49.2% and 48.0% of pictures respectively (Table 43). Prints, engravings and composite designs have been noted, but they are rare. The engravings consist of a pounded lizard, a circle, a curvilinear maze and an indeterminate motif. The compound design consists of a red infill catfish with pounded spots.

PAINTINGS

Paintings are generally monochrome infilled, with red being the dominant colour used (55.6%) (Table 44; Fig. 48). Some red and white bichromes are also present, most of which consist of white outlined/red infilled designs. Bichrome designs sometimes contain internal decorations, such as horizontal and/or vertical lines (Figs 49-50). Such internal decorations are invariably of the same colour as the outlining, which is usually white.

The paintings at Jackass Station are characterised by a broad suite of figurative designs. The predominant forms are flying foxes (33.8%) and humans (19.2%) (Figs 48, 49). The faunal range represented is considerable, despite the small sample size. Non-figurative designs are relatively uncommon, contributing 4.0% of total pictures. Animal (bird) tracks are also present but uncommon (5.3%) (Table 45).

The anthropomorphs are oriented in horizontal as well as vertical positions, with fourteen pictures in each case (one anthropomorph was too faded to determine its orientation) (Fig. 51). We shall return to this point below.

STENCILS AND PRINTS

Both stencils and prints are present. With the exception of two boomerang and two foot stencils, all other stencils and prints are of hands, with no evidence of mutilation or bending of fingers. All stencils and prints were undertaken in monochrome.

DISCUSSION

The Jackass Station rock art is dominated by figurative paintings and plain hand stencils, both of which are predominantly monochrome. A wide



FIG. 47. The entrance to Rocky Creek gorge, Jackass Station.



FIG. 48. Red monochrome anthropomorph, a red outlined and internally decorated zoomorph, hand prints, hand stencils, and a white outlined, red infilled, white internally decorated design, Jackass Station.



FIG. 49. White outlined, red infilled and white internally-decorated painted flying foxes, Jackass Station.



FIG. 50. White outlined, red infilled and white internally decorated (sectioned) zoomorph, Jackass Station.

range of faunal types are represented, as well as anthropomorphs oriented horizontally or vertically.

JOWALBINNA

Like Jackass Station, the Jowalbinna area consists of broad plains to the north and dissected ranges to the south, the latter containing rugged cliff-lines sheltering numerous overhangs. Cole (1988) has undertaken detailed analyses of 59 rock art sites and 2,485 determinate pictures from Brady and Shepherd Creeks for her honours thesis at James Cook University (Cole, 1988). This rock art is very similar to that from other parts of Laura (David, 1994).

The principle motif forms at Jowalbinna are anthropomorphs (Cole, 1992; David & Cole, 1991). Huchet (1990b) has identified the occurrence of repeated design elements, such as horizontal lines across the chest, on painted anthropomorphs from various parts of Laura, including the south. He argues that in many cases they may represent body scars, such as those that have been documented ethnographically from the area.

LAURA RIVER

In her review of Australian rock art, Maynard (1976) compared the paintings and engravings from a number of sites located to the east of the Laura River with that from other parts of Australia. Her numerical analyses of the Laura art were based on her own recordings, as well as on the work of Trezise (1969; 1971).



FIG. 51. George Musgrave Snr. standing in front of Site 2, Jackass Station. Note the 'pendant' on the anthropomorph.

PAINTINGS

Maynard's analysis of cave paintings in the Laura River area is based on the art of five rock-shelters: Giant Horse, Quinkan, Split Rock, Pig and Emu, and Crocodile. Together, they contain 941 paintings, the majority of which are red monochrome (39%) or red and white bichrome (31%) (Table 46) (Maynard, 1976; table 5:13)³. All paintings are monochrome (55%) or bichrome (45%); no black paintings have been noted.

Most of the Laura River paintings consist of figurative pictures (79.8%), with non-figurative (17.1%) and animal tracks also present (3.1%) (Figs 52, 53). Anthropomorphs are the most common designs (41.9%), while a broad range of faunal types are also represented (Table 47). Maynard (1976: 144) characterised the Laura River paintings as being mainly linear, infilled or outlined/infilled. Interior decorations also occur. Motif forms are predominantly figurative, and body shapes are usually generalised and infilled.

Within this general trend, Maynard also noted that '*... there are also some exceptional figures which do not completely conform to any of [the above] ... but which do not display any consistent pattern of traits of their own. The 'Knobbly Man' in Main Overhang, Split Rock Gallery, is one example of a figure which, unlike most Laura motifs, has a particular 'character' — contorted limbs, enlarged joints, detailed infill and elongated penis. Exceptional motifs are normal in any Australian rock art area; they do not, in my opinion, interfere with the integrity of the identified styles.*' (1976: 145).

Some of Maynard's Knobbly Man paintings are the Quinkan designs endemic to Laura. In spite of Maynard's claims, they are not particularly anomalous in the Laura River area, let alone in the broader Laura subregion (Fig. 54). Such figures follow the same conventions used in other



FIG. 52. Painted anthropomorphs (Quinkans), Quinkan Galleries, Laura River (photograph by J. Flood).

figurative designs, including the use of generalised body shapes with the addition of specific features. Although such motifs are varied in form, they nevertheless contain recurrent traits throughout the Laura region.

ENGRAVINGS

Maynard (1976; table 6:1) analysed 253 peckings from the Laura River. Her analysis is based on data supplied by Woolston & Trezise (1969),

³ Maynard (1976: table 5:13) writes that 954 paintings were identified, but her tables only add-up to 941.



FIG. 53. Paintings, Giant Horse Gallery, Laura River.

with the exclusion of their Hann River sites. The peckings are mainly of non-figurative and track motifs, plus some rare figurative designs (Table 48, fig. 55). In her Table 6:1, Maynard did not differentiate between the various figurative motifs, but noted that they include a predominance of anthropomorphs.

ANTIQUITY OF THE ROCK ART

TREZISE'S MODEL

The earliest chronological model of Laura's rock art was forwarded by Trezise (Woolston & Trezise, 1969). He suggested that a general progression of forms could be observed from non-figurative to figurative pictures, and that pigmented art progressed linearly from stencils and outlined paintings to infilled monochrome and bichrome and finally to 'mud man' paintings throughout the Laura region. Trezise's model was based on detailed observations of degrees of weathering and patination, as well as on superimpositions. Unfortunately, however, the absence of appropriate quantitative data has made it difficult for independent researchers to adequately assess Trezise's claims.

ROSENFELD'S MODEL

Until recently, the most tangible indication of the antiquity of rock art anywhere in north Queensland came from Laura. Excavations at the Early Man Rockshelter (Rosenfeld et al., 1981) revealed a range of engraved motifs dated stratigraphically to over 13,000BP. They included '*pits, tridents and their variants, rectilinear mazes, rings around natural depressions and rounded enclosures with internal designs*' (Rosenfeld et al., 1981: 86-7). Noticing that early engravings from the Early Man site were similar to the patinated engravings from other sites around Laura (e.g. Fig. 56), Rosenfeld (Rosenfeld et al., 1981) presented a tentative chronology for the Laura engravings, modifying the relative sequence proposed by Woolston & Trezise in 1969. She identified three broad artistic traditions:

- 1, an early, non-figurative tradition, typified by the earliest, stratified Early Man engravings and dated to pre-13,000BP times;
- 2, a later, non-figurative style, which retained some of the Early Man elements, but eliminated others, and were thought to occur in association with figurative engravings and paintings; and



FIG. 54. Painted anthropomorph (Maynard's 'Knobbly Man' design), Split Rock, Laura River.

3, a complex of figurative images, including tracks, anthropomorphs and items of material culture, as well as non-figurative designs. This relatively recent tradition could be observed archaeologically at a site known as the Laura River Complex, and was believed to be contemporaneous with the majority of paintings in the area. This complex was believed to date from 5,000BP to the relatively recent past, as bird tracks of this tradition had been dated stratigraphically to post-5000BP, and track

motifs have occurred superimposed over paintings (Rosenfeld et al., 1981: 88).

One of the key issues of the Early Man engravings concerns three and four pronged motifs (tridents and bird tracks). In her analysis of the site, Rosenfeld (Rosenfeld et al., 1981) distinguished bird tracks from tridents by the form of the meeting point of the prongs (Appendix A). Flood (1987), following Rosenfeld, claimed that there is a total absence of bird tracks from the earliest part of Rosenfeld's chronological scheme, but Trezise (1987: 124) disputed this point, prompting Clegg (1988) to argue that the entire distinction between tridents and bird tracks needs to be reviewed. This issue may be important, as it potentially addresses whether or not the Laura engravings followed a sequence from early, non-figurative forms to later, figurative ones via the appearance of animal tracks.

SUPERIMPOSITIONS

In spite of the considerable attention received, the rock art of the Laura region has still not been adequately dated. This is so of both relative and absolute chronologies. Most statements on the art's antiquity are idiosyncratic in nature, although one trend which appears to be agreed upon by most researchers is that engravings tend to occur beneath paintings when the two are in superimposition. But even this is not clear-cut, as in some

(albeit rare) cases engravings have been observed over paintings (e.g. Rosenfeld et al., 1981: 50). Perhaps the most that can be said is that at least some non-figurative, pecked engravings have considerable antiquity in the area.

THE AMPHITHEATRE SITE

It is hypothesised from the above trends that paintings (mainly figurative) and figurative peckings may have been added to — but did not replace — an existing, predominantly track and

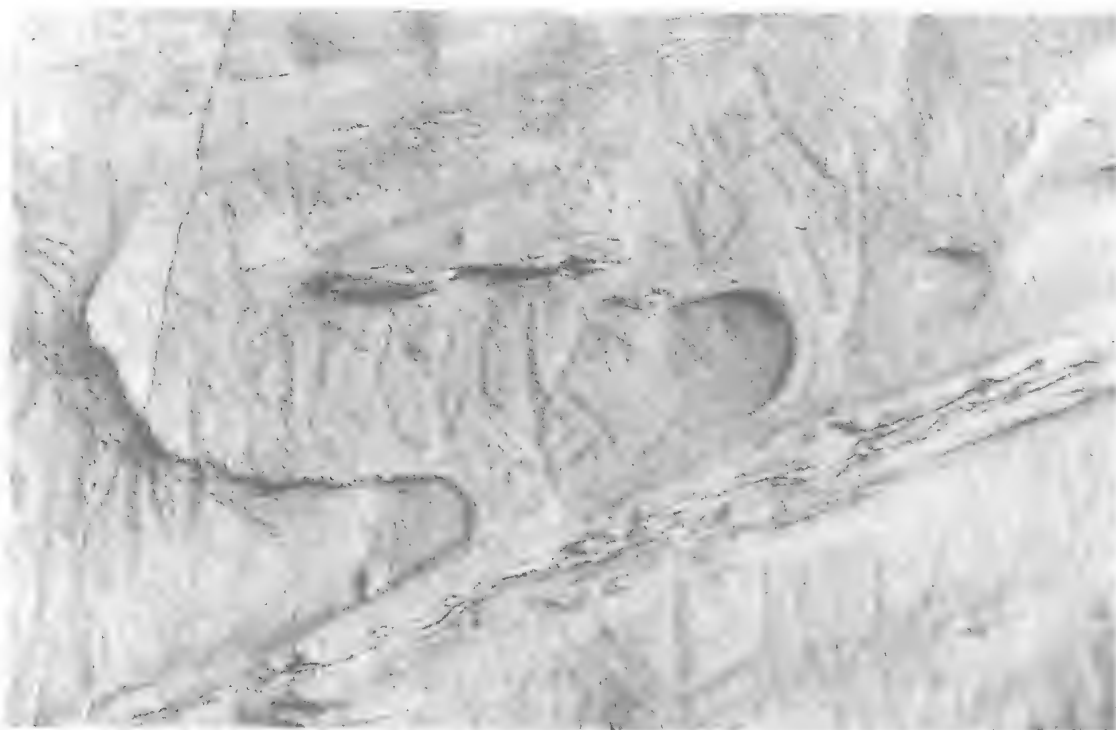


FIG. 55. Non-figurative peckings, Early Man Rockshelter, Laura River (photograph by J. Flood).

non-figurative engraving tradition during relatively recent times. Such a model has been given added weight by the rediscovery of the Amphitheatre Site, near Laura (Cole & Trezise, 1992). Situated on an open-air rock surface, the large, pecked figurative designs, most of which remain in good condition, are reminiscent of Laura's painted images, both in terms of motif forms and compositions (Fig. 57). Cole & Trezise (1992: 84) note that '*... in the engraved group and in several of the painted compositions a smaller, child-like figure appears to be attached to larger figures of adult size*'. One engraved figure has curved arms arching over its head, '*reminiscent of some painted Laura Quinkans*' (Cole & Trezise, 1992: 84). Other similarities include detailed depictions of fingers and toes on anthropomorphs and animal forms such as emus and dingoes. Given the dingo's mid to late Holocene antiquity in Australia, at least some of the engravings from this site date to the last 4,000-3,500 years. Furthermore, the Amphitheatre Site does not contain any motifs resembling those found by Rosenfeld in the stratified levels at Early Man (e.g. pits), adding support to the assumption that the Amphitheatre Site may be relatively recent. As Cole & Trezise

(1992: 86) concluded, '*... the suite of motifs currently recorded at the Amphitheatre Site presents the best evidence so far for a figurative style which was embraced in this region by the two major rock art techniques of painting and engraving*'.

These observations are particularly important given the difficulty of dating rock art. So far, there has been a tendency to differentiate between engravings and paintings from the area, and to allocate different temporal frameworks to each technique (e.g. David, 1991a; Flood, 1987; Rosenfeld et al., 1981). At the Amphitheatre Site, however, there is a hint that figurative engravings may have been contemporaneous with paintings of similar forms. Given the unpatinated, non-figurative peckings in the broader area, and the occasional (but rare) unpatinated peckings over paintings, the implications are that peckings continued to be produced in the Laura area until very recent times. Nevertheless, as Rosenfeld et al. noted above, there is still a general tendency for paintings to be superimposed over engravings, and for some forms of the latter to be very heavily patinated. The implication is that the majority of engravings may pre-date the paintings.

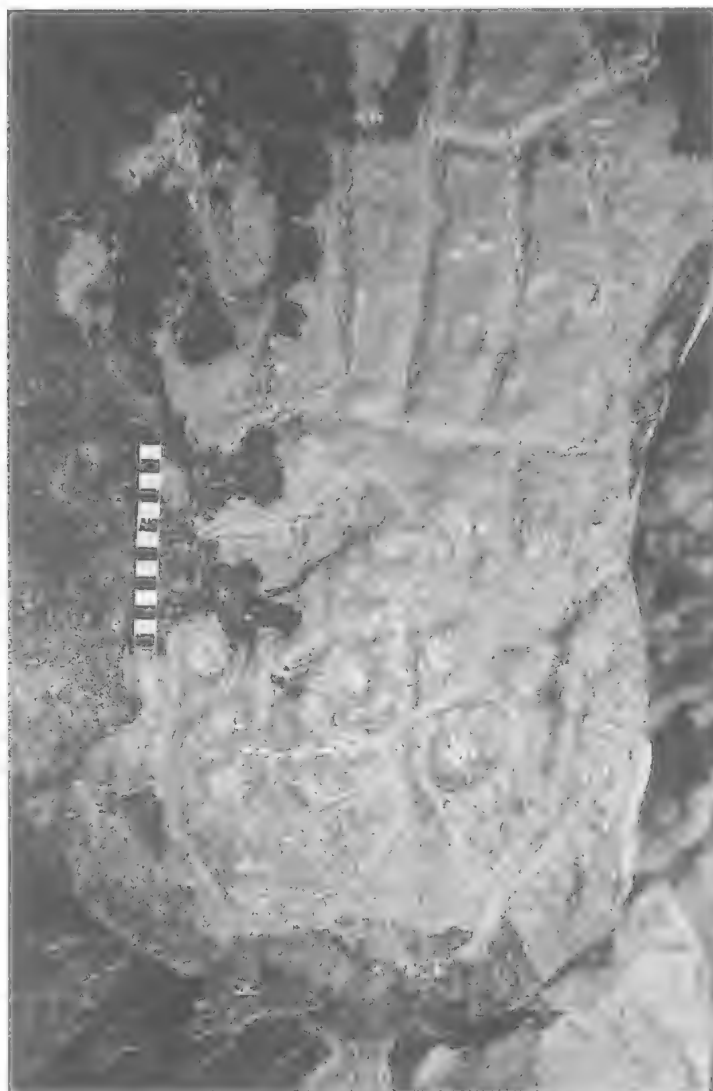


FIG. 56. Patinated peckings, Sandy Creek (photograph by J. Flood).

STRATIFIED PIGMENTS

Our understanding of the absolute antiquity of paintings and engravings are enhanced by excavations at Early Man and other sites. At Early Man, deposition rates of stratified pigment increased significantly sometime after c.1,800BP, with similar increases in deposition rates of cultural materials after c.1,000BP at Yam Camp, and 1,900-1,200BP at Sandy Creek 1. Together, these results suggest that systemic changes in artistic practices may have taken place throughout the area during the late Holocene. Such changes may

have involved significant increases in painting and stencilling practices during the last 2,000 years or so.

DINGOES AND CONTACT FAUNA

One of the noticeable features of Laura's rock paintings are their depictions of contact motifs. Horses (e.g. Giant Horse Gallery), pigs and other fauna are painted in conventions typical of the Laura area. While contact motifs are often painted, they are never engraved. The implication is that Laura's paintings, dominated by figurative motifs with generalised body forms (in outline/infill or infill, and which often contain internal decorations such as horizontal and perpendicular lines) continued to be made until very recent times. The majority of paintings from the area appear to be part of a single artistic tradition which included the recent, contact images.

Similarly, paintings of dogs are common. With the exception of the one recently recorded from the Amphitheatre Site, engraved dogs do not occur. As noted above, the engravings at this site are not typical of the area, and stylistically they are more closely related to the paintings than to the vast majority of engravings.

AMS DATES

Two AMS radiocarbon dates have been obtained from paintings at Yam Camp. The dates were obtained by Watchman & Cole (1993), who dated plant fibres included within the pigment matrix of two female figures. Both figures are white kaolinite paintings, and they are typical of the Laura figurative paintings. The dates obtained are 725 ± 111 BP and 730 ± 75 BP. Watchman and Cole (1993: 357) noted that the radiocarbon dates '*are archaeologically consistent with the abundant pigment fragments excavated at YC [Yam Camp]*'.

DISCUSSION

David & Cole have concluded that '... the Early Man excavations have confirmed the impression that the engraving technique is of considerable antiquity at Laura, and that the early style differs greatly from engravings in more recent contexts. The development of figurative engravings seems to be a recent facet of the region's engraved art, although it is possible that early track engravings exist. The relationship between stencils and engravings is obscure since they are rarely observed in direct association, but superimpositions involving paintings and stencils suggest that the use of the stencilling technique has at least been concurrent with the development of painting at Laura (and may even have preceded it).' (David & Cole, 1989: no page numbers).

The distribution of stratified ochres at Early Man and other excavated sites indicates that pigment art is largely a mid to late Holocene activity,



FIG. 57. The Amphitheatre Site, peckings (after Cole & Trezise, 1992,

probably dating mainly to the last c.1,800 years. The two AMS dates support these claims. It may also be relevant to note that in one site, engravings reminiscent of Laura's paintings have recently been found. These include a pecked dingo, and must therefore date to post 4,000-3,500BP times. Patinated (earlier?) engravings, on the other hand,



FIG. 58. Complex composition, Laura paintings.

are all of non-figurative or track designs. This pattern is comparable to the one documented by Flood for the Koolburra Plateau.

While figurative paintings are numerically and visually predominant in the Laura region, the pecked art is mainly characterised by a suite of non-figurative and track motifs qualitatively different from the paintings. The paintings consist predominantly (but not exclusively) of a broad range of zoomorphs and anthropomorphs, including many which possess internal decorations such as lines or dots. Most of the Laura paintings in this way appear to belong to a single painting tradition. Although the appearance of a wide range of zoomorphs is characteristic of the Laura paintings, body shapes tend to be relatively generalised. As Rosenfeld has noted of faunal representations at Laura: *'Animals are painted from their most characteristic aspects, which for most birds, fish and animals is a profile view ... In Laura art the overall characteristics of body shape show no clear distinction between species ... the representations of furred animals in Laura art tend to conform to a generalised, though not highly standardised configuration of body-head-legs, to which characterising anatomical traits may, or may not, be added.'* (1984: 404-412).

Despite this, Rosenfeld (1982) was able to differentiate between particular categories of furred animals at Laura by virtue of metrical characteristics alone, with animals such as dogs, possums and macropods being differentiated by differences in the relative proportions of body parts.

Rosenfeld (1982: 201-2) noted that compositions at Laura are *'frequently ... haphazard'*. Others, however, have noted recurring associations between particular motif types (e.g. Cole & Trezise, 1992). For instance, large birds are often associated with sets of infilled oval shapes (eggs), and this may imply that pictures in the area may be arranged into meaningful sets worthy of further investigation. Faulstich (1986) has likewise noted that certain designs are repeatedly associated, juxtaposed or superimposed over specific motifs. The conclusion reached is that composition is not random (Figs 58, 59). Although research along these lines has been very limited, the finding of meaningful patterns elsewhere indicates that such an approach may warrant further research (e.g. Leroi-Gourhan, 1958, 1968; Sauvet & Sauvet, 1979; Sauvet et al., 1977; Vialou pers. comm., 1988). It presupposes that the positioning of images on a wall was subject to symbolic conventions which could be inves-



FIG. 59. Composition involving two juxtaposed anthropomorphs, and a hand stencil in superimposition over a painting, Laura.

tigated archaeologically. Furthermore, as Sauvet & Sauvet (1979) have demonstrated for the Upper Palaeolithic of southern France, individual motif forms, such as non-figurative designs, may be viewed in new light, in that specific forms may be found to be meaningfully associated with specific figurative designs. For instance, they noted that: *'Pour un observateur actuel, l'iconographie de l'art pariétal paléolithique se réduit à deux types de représentations: d'une part, des êtres vivants, animaux et humains; d'autre part, des signes non figuratifs. Nous avons montré dans un travail précédent (Sauvet G. et S., Włodarczyk, 1977) que ces derniers possédaient toutes les caractéristiques d'un système de communication graphique assez élaboré dans lequel on pouvait reconnaître des signes composites formés de deux ou plusieurs éléments juxtaposés, superposés ou même intégrés, ainsi que l'ébauche d'une véritable syntaxe.'*

Nous avons cependant fait observer que 60% de ces signes apparaissaient dans un contexte

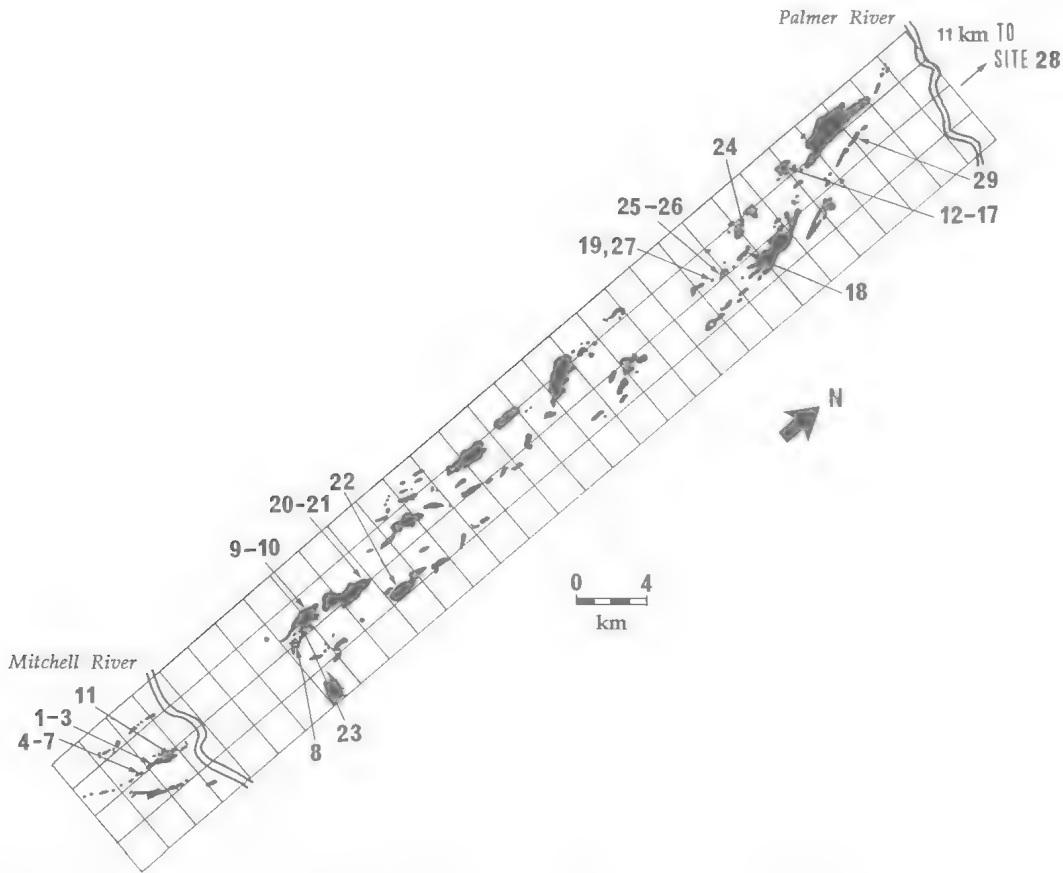


FIG. 60. The Mitchell-Palmer limestone belt, showing the locations of recorded sites.

animalier et que cela rendait probable l'existence de relations fonctionnelles entre les deux groupes de figures.' (Sauvet & Sauvet, 1979: 340).

Although a proper investigation of these issues is beyond the present discussion, it is worth noting that north Queensland's art is spatially structured within individual sites, as well as between them, and that preliminary investigations of intra-site structure have already revealed meaningful associations. Unfortunately, these investigations have not yet been undertaken within a diachronic framework.

THE ROCK ART OF THE MITCHELL-PALMER LIMESTONE BELT

The only archaeological surveys to have been undertaken in the Mitchell-Palmer limestone belt took place in the late 1980s and early 1990s, specifically for the purposes of this research (David, 1994). These surveys were subdivided

into two geographical areas, although the limestone belt itself is continuous (Fig. 60):

1, a northern section, where a series of rockshelters were recorded within 14km of the Palmer River; and

2, a southern section, where rock art sites occurred within 11km of the Mitchell River.

These two groups are separated by 24km of terrain where surveys were not attempted.

THE PALMER RIVER LIMESTONE

Some 284 cave pictures from 14 sites were recorded from the Palmer River limestones. Paintings are predominant, accounting for 93.3% of the rock art, while peckings, hand stencils and composite designs are also present (Table 49). In addition, abraded grooves were also recorded, but these have not been considered here, as we are not certain whether or not they were a bi-product of tool sharpening. Their status as rock art is, therefore, questionable.

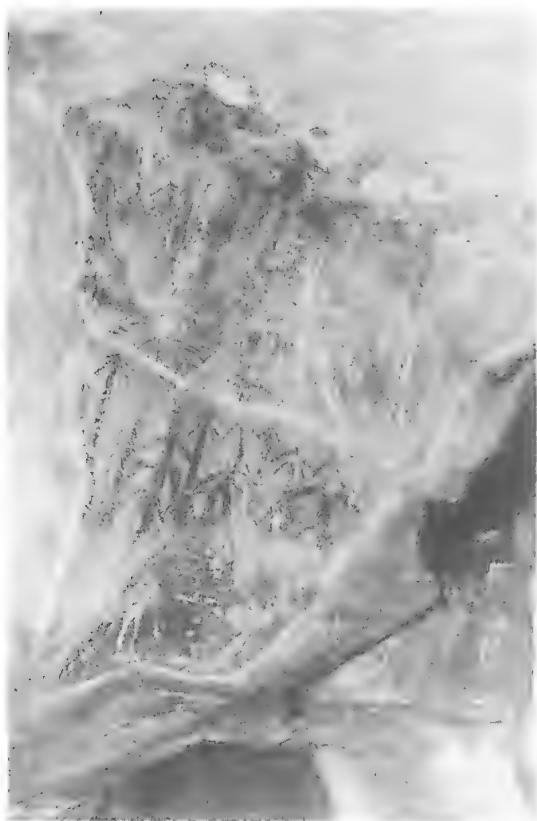


FIG. 61. Anthropomorphs and non-figurative designs, Palmer River.

PAINTINGS

The Palmer River paintings contain a narrow range of forms dominated by monochrome infilled anthropomorphs (Tables 50, 51; Fig. 61). Red is by far the most common colour used, accounting for 70.7% of monochrome paintings. The anthropomorphs usually occur in an upright position (86.8% of anthropomorphs), although upside-down (5.5%), horizontal (4.5%) and oblique (3.2%) forms also occur (Table 52). The practice of painting anthropomorphs almost exclusively in monochrome infill distinguishes them from those of Laura to the north, where a broad range of internal designs have been recorded. The only zoomorphs identified from the Palmer River are dogs and a bird, both of which were painted in profile view. There is little attention paid to anatomical detail, each image possessing a generalised body shape with a small number of species-specific traits added-on (e.g. upturned tail and four equal-sized limbs for dogs; two

long legs and an elongated neck for the bird painting).

The non-figurative designs are mainly geometric in form, most of which consist of single vertical lines. Many of these lines are located near large sets of vertical anthropomorphs, and, formally, they are very similar to the anthropomorph torsos (e.g. Fig. 61). Nevertheless, in the present analysis each picture is identified without reference to surrounding pictures, and therefore pictures consisting of single lines are, by definition, categorised along with geometric or other linear figures (depending on their degree of linearity and symmetry).

OTHER TECHNIQUES

Peckings, stencils and composite pictures are also present. Peckings consist entirely of non-figurative and track forms (Table 53), whereas composite pictures consist of six painted anthropomorphs with lightly abraded (scratched) sections, and a single painted geometric non-figurative design which also possesses scratched areas. A single red hand stencil was observed.

THE MITCHELL RIVER LIMESTONE

The rock art of the Mitchell River area is very similar to that of the Palmer River. Some 760 pictures were recorded from 15 sites, and most of these were paintings (93.3%) (Table 54). This is identical to the proportion of paintings documented from the Palmer River (note that abraded grooves were also recorded from the Mitchell River subregion).

PAINTINGS

The main colour used is red, which accounts for 53.2% of the monochrome paintings. The convention of painting in monochrome is dominant (86.8% of the painted assemblage), and infilling is the principle mode of painting (Table 55). Again, this is similar to the situation documented from the Palmer River to the north. The majority of paintings are anthropomorphs (69.8%), most of which are depicted vertically (Tables 52, 56). Proportions of different motif types are similar to those of the Palmer River, although the range of faunal categories is broader in the Mitchell River area (Figs 62, 66). This, however, may simply be due to the latter's larger sample size.

OTHER TECHNIQUES

Both stencils and prints are present, including 33 hand stencils, one boomerang stencil, and one

hand print. All stencils are monochrome red, as is the hand print.

The peckings consist of macropod tracks and non-figurative designs as well as a single pecked bird (Table 57). Non-figurative, geometric forms predominate, although peckings are never abundant (Fig. 67).

ANTIQUITY OF THE ART

SUPERIMPOSITIONS

Few pictures from the Mitchell-Palmer limestone belt occur in superimposition. The only cases of paintings and peckings occurring in superimposition are at Hearth Cave, where paintings are repeatedly placed over peckings. Here, two sets of deeply pecked pits are located beneath two paintings, pecked concentric circles occur beneath five paintings, and a small number of indeterminate peckings occur below a series of paintings (Fig. 68). In all cases, the underlying images (peckings) are non-figurative, while the overlying ones (paintings) are figurative. Note also that in the only two times when non-figurative and figurative paintings occur in superimposition, the latter lie on top.

STRATIFIED PIGMENTS

All of the excavations from the Mitchell-Palmer limestone belt have revealed stratified earth pigments in mid to late Holocene deposits. At Mordor Cave, this coincides with the beginnings of occupation c.1,500BP, with a peak around 800BP. At Mitchell River Cave, the only fragment of stratified ochre came from XU3, dated to c.1,000BP, while at Hearth Cave, an 18-fold increase in the number of ochre fragments occurred after c.3,850BP.

DINGOES

Twenty-three dog paintings occur (Fig. 69). They are especially common at Mordor Cave, where 11 have been noted. Given the antiquity of dingoes in Australia, these paintings cannot be any older than 4,000-3,500BP. That the main, back wall at Mordor Cave is entirely covered with paintings and stencils, with very few superimpositions (the individual pictures are fairly evenly spaced), suggests that the paintings and stencils may have been executed in the context of a single spatial and compositional framework. Sections of the back wall have not been preferentially decorated (paintings are not clustered in any particular area), and since dingoes take a prominent (and relatively central) position in this panel, and



FIG. 62. Painted bird, Mitchell River.

appear to follow the same spatial and compositional rules as are evident in the panel as a whole, it is unlikely that the dingo paintings were made towards the end of a prolonged period of painting at the site. Rather, the dingo paintings can be treated as typical of the panel as a whole, and this is so of both design conventions (e.g. infilling, outlining/infilling, generalised body shapes) and spatial conventions (lack of superimposition, evenly spaced images). The implication is that it is highly unlikely that the painted dingoes post-date the rest of the paintings. In effect, the entire main painted panel at Mordor Cave is likely to have been created after about 4,000-3,500BP. This is supported by the late Holocene antiquity of occupation deposits at the site.

UNSTABLE PIGMENTS

A large proportion of paintings contain white pigments (10.4% at the Palmer River, and 20.5% at the Mitchell River). Given that such pigments are generally unstable, the white paintings are unlikely to be very old. In addition to this, 2.5%



FIG. 63. Anthropomorph painted upside-down, Mitchell River.



FIG. 64. Anthropomorph painted upside-down, Mitchell River. This figure is more elaborate than most other anthropomorphs from the Mitchell River.

(Palmer River) and 11.7% (Mitchell River) of paintings were undertaken in mud. These are extremely fragile, consisting of thickly coated mud designs, many of which are currently exfoliating off the rock walls (e.g. Fig. 66). The mud used appears to have been obtained locally, if not from the caves themselves, as the pigments have the same appearance as the sediments located on the adjacent cave floors (often containing the remains of numerous micro-organisms that are visible to the naked eye). The extreme fragility of these paintings, and their current state of deterioration, suggests that they are probably very recent in age (probably dating in hundreds rather than thousands of years).

DEGREES OF PATINATION AND WEATHERING

All of the peckings from the Mitchell-Palmer limestone belt are very patinated, suggesting that they probably have considerable antiquity. In contrast, most of the paintings are clear and ap-

pear relatively fresh. However, the two non-figurative grid paintings subimposed underneath figurative paintings are very faded (see Superimpositions above).

DISCUSSION

The Mitchell-Palmer limestone belt contains a homogeneous body of rock art dominated by anthropomorphic and zoomorphic paintings. For the most part, they occur as monochrome infilled designs, executed principally in red. The anthropomorphs occur horizontally, vertically, upside-down and obliqually, and their relative proportions are similar at both ends of the limestone belt (Table 52). Anthropomorphs are highly standardised, in the sense that they consist primarily of generalised figures possessing heads, torsos, legs and arms, with the occasional addition of fingers or toes (in varying numbers). In the case of males, penises are added, and in



FIG. 65. Painted zoomorphs and anthropomorphs, Mitchell River.



FIG. 66. Geometric non-figurative designs and faded anthropomorphs, Mitchell River. These pictures were painted in mud.

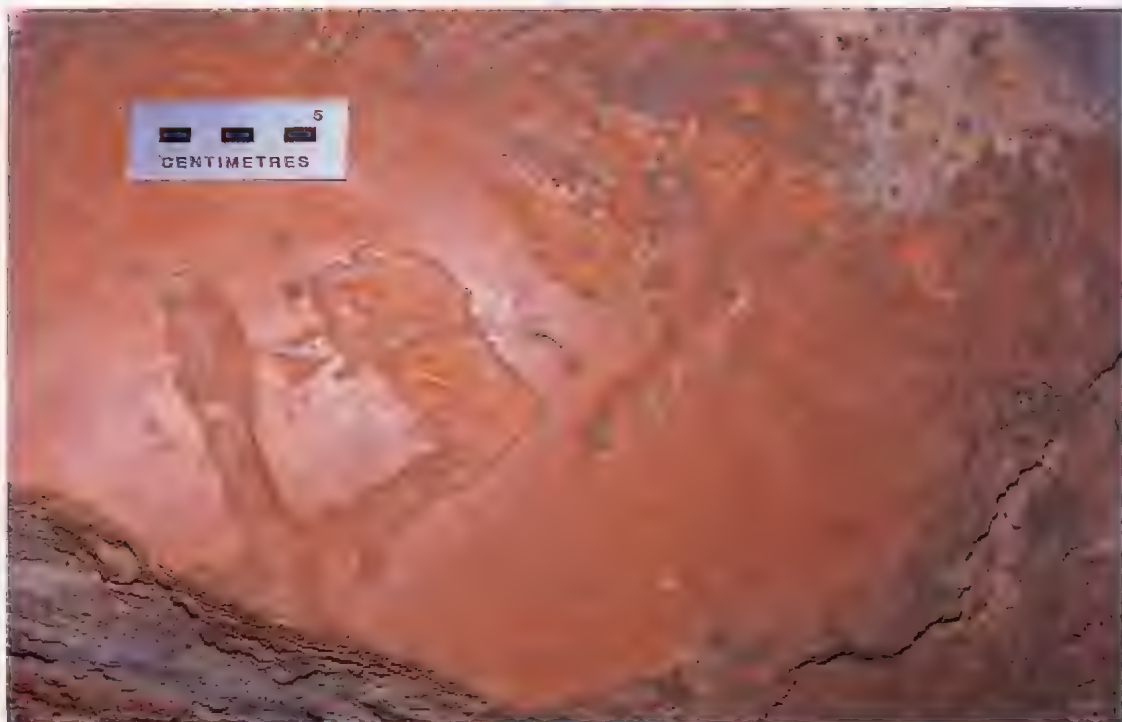


FIG. 67. Heavily patinated, pecked non-figurative designs, Mitchell River.

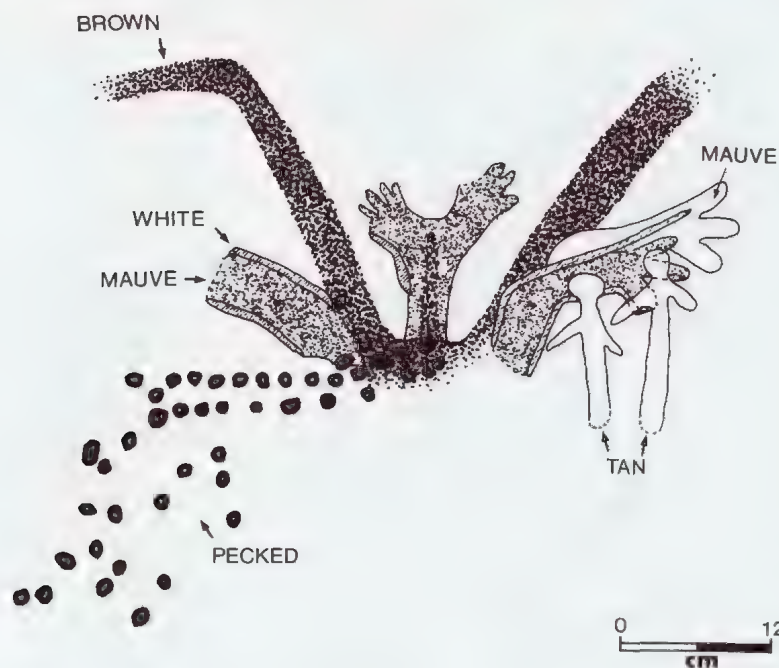


FIG. 68. Paintings over peckings, Hearth Cave, Palmer River.

females, breasts. A small number of anthropomorphs have more defined external anatomical parts, such as elbows, heels, eyes, ears and/or headdresses, but this is extremely rare (Fig. 64). Few anthropomorphs show any evidence of internal decoration.

Zoomorphs are essentially similar to anthropomorphs, in that body shapes tend to be generalised. They are often undertaken in profile, and this is especially so of the larger animals such as dogs and birds. Other animals, such as flying foxes, are painted front-on, while turtles are depicted in plan view. In each case, the picture captures that animal's most characteristic features, while simplifying the complexity of its separate anatomical parts. For ex-



FIG. 69. Painting of a dog, Mordor Cave, Mitchell-Palmer limestone belt.

ample, the profile view of birds highlights the elongated legs and neck, and pays particular attention to the beak. Often, feathers are also represented, as are the trident feet in twisted perspective. All other features, however, are highly generalised, with anatomical features, such as joints, eyes and other features not specifically characteristic of that animal, left out. Most zoomorphs exhibit no evidence of internal elaboration.

A particular point of interest is the absence of snakes and macropods in the art. This is unusual for a predominantly figurative tradition in north Queensland. Macropods are common in the landscape today, and they are also the largest animal in the bush. They are also common in the rock art of Laura to the north, although their absence was also noted in the Koolburra Plateau to the northwest.

As was the case at the Koolburra Plateau and Princess Charlotte Bay and the Flinders Island group, the evidence for the rock art's antiquity is circumstantial only. It is suggested that the figurative paintings largely postdate the non-figurative and track peckings. The reasons for this have been outlined above. As elsewhere, the precise antiquity of the area's rock art cannot yet

be firmly established, and will have to await further research, including the obtaining of a large number of direct (AMS) dates.

THE ROCK ART OF BONNY GLEN STATION, MT WINDSOR/MT CARBINE AND BARE HILL

BONNY GLEN STATION

Bonny Glen Station is located 60km southeast of Laura. It consists of granite hills containing shallow cliffs in localised areas. Here, one of us (BD) surveyed for rock art sites along the northwestern slopes of the range known as The Granites (David, 1992d) (Fig. 70). Along Granite Creek, eight rock art sites were identified. All of the rock art consisted of paintings. As has been observed for north Queensland generally, engravings do not tend to occur in granite formations, and this may be due to the hardness of the rock matrix (Cole & David, 1992).

Only 37 rock paintings were recorded from Bonny Glen Station, and any generalisation should therefore be treated with caution. The

paintings appear to constitute a variant of a broader regional style (which includes the paintings from the other subregions, characterised by figurative motifs with generalised body shapes. As was the case at Laura and the Mitchell-Palmer limestone belt, anthropomorphs predominate, contributing 62.2% of the total painted assemblage. Zoomorphs contribute 2.7%. All non-figurative figures are linear in execution, consisting of ten single lines and two grids (Table 58). Red monochrome designs are common, accounting for 80.0% of pictures (Table 59) (Fig. 71).

Anthropomorphs occur as monochrome infilled and bichrome, outlined/infilled figures. They are predominantly upright (vertical) in orientation, although horizontal forms are also common (Table 60, Fig. 72).

MT WINDSOR AND MT CARBINE

Mt Windsor and Mt Carbine are 20km east-southeast of Bonny Glen Station, on the western side of the Great Dividing Range. Granite boulders are common along the lower slopes, some of which contain overhangs sheltering rock art. Systematic archaeological surveys were undertaken there by M. David in 1988 and 1989 as

part of two separate ANZSES projects, when a number of rock art sites were recorded (M. David, 1989, 1990).

Painting is the only technique represented, with 143 determinate figures having been recorded from seven sites. Most paintings are monochrome infilled red designs (Table 61). Figurative paintings, and especially anthropomorphs, predominate (Table 62, Fig. 73). The latter are all vertical, and the absence of upside-down and horizontal anthropomorphs is interesting given that they are common at Bonny Glen and in the Mitchell-Palmer limestone belt to the immediate west. Anthropomorphs at Mt Windsor and Mt Carbine have generalised body shapes, containing torsos, limbs and heads, but generally lack further embellishments, as was the case in other subregions to the west. Males are depicted with penises, but no anthropomorphs depicting breasts have been noted. A small number (9.6%) contain concentric circle, split circle or rayed 'headdresses', always painted in the same colour as the body (Fig. 74). Non-figurative paintings are also present, consisting principally of single lines, grids and a few amorphous curvilinear motifs (Fig. 75). The general impression is of a painting tradition largely consisting of monochrome infilled anthropomorphs, lacking internal differentiation and possessing highly generalised anatomical



FIG. 70. The boulder-strewn slopes near Granite Creek, Bonny Glen Station.



FIG. 71. Site 1, Bonny Glen Station, showing the major painting conventions used.

forms. The lack of anatomical detail is accentuated by the use of single colours (monochrome). In these ways, the paintings are reminiscent of those from the Mitchell-Palmer limestone belt, and they are similar also to many of the Laura paintings.

BARE HILL

Bare Hill is located along the upper slopes of the Great Dividing Range, in a rugged, dissected landscape containing numerous granite boulders (60km southeast of Mt. Carbine). During the late 1940s and early 1950s, Seaton (n.d.), an amateur rock art enthusiast from Cairns, recorded four rock art sites from the area. In 1965, Clegg (1978) recorded six sites and 149 rock paintings, many of which were in a bad state of preservation.



FIG. 72. Anthropomorphs, Bonny Glen Station.

Clegg's recordings show a painting tradition dominated by monochrome infilled anthropomorphs, all of which have bent legs and bent, raised arms (Fig. 76). These depictions are found in all of the sites recorded by him. As Clegg (1978) does not give a colour

breakdown of the paintings he recorded, one of us (BD) returned to three of these sites in 1988 to record their colours. The following analysis of colours is from David's re-recordings of the 118 paintings from these three sites, but all other analysis is based on Clegg's (1978) original work.

Red is the most common colour used, accounting for 64.4% of monochrome paintings. Other commonly used colours are orange (15.2%), yellow (11.8%) and white (5.9%). No black paintings were observed (Table 63).

Anthropomorphs occur vertically, horizontally or obliquely (85.7%, 13.3% and 2.9%, respectively). No inverted (upside-down) anthropomorphs occur at Bare Hill. Other common motifs include zoomorphs, particularly macropods, birds and snakes, all of which were also undertaken in infilled monochrome or in outlined and infilled bichrome. Non-figurative designs, such as double-arcs, single lines, circles and rayed circles are present but rare (Table 64, Fig. 76).

ANTIQUITY

After examining the characteristics of the anthropomorphs at Bare Hill, Clegg (1978: 12) concluded that the paintings had been created by different individuals at various times, and that the patterning of pictures at the sites was not random. He also concluded that all of the paintings investigated were probably undertaken within a single cultural tradition. This suggests that the time span covered by this



FIG. 73. Weathered anthropomorphs, Site DF18 (Twin Bat Cave) (after M. David, 1990, fig. 16).

body of paintings was probably not very great. Nevertheless, Clegg (1978) also concluded that the main site (Site 1) was probably decorated as a result of several painting events.

The presence of six dog paintings implies that at least some of the art is less than 4,000-3,500 years old. Further support for this also comes from the observation that 7.5% of the paintings contain white pigments. Given the unstable character of such pigments, especially in humid conditions such as Bare Hill, they are unlikely to be very old.

DISCUSSION

The rock art of Bare Hill is dominated by paintings of anthropomorphs possessing up-turned arms and bent legs, most of which were undertaken in monochrome red infill. Such depictions appear to be endemic to the Bare Hill area (rainforest margins), and have not been observed from the other subregions (see also Horsfall, 1987). Zoomorphs occur in a range of forms, as do the less numerous, non-figurative linear designs. Most, if not all, of the paintings at Bare Hill are probably recent in age (late Holocene).

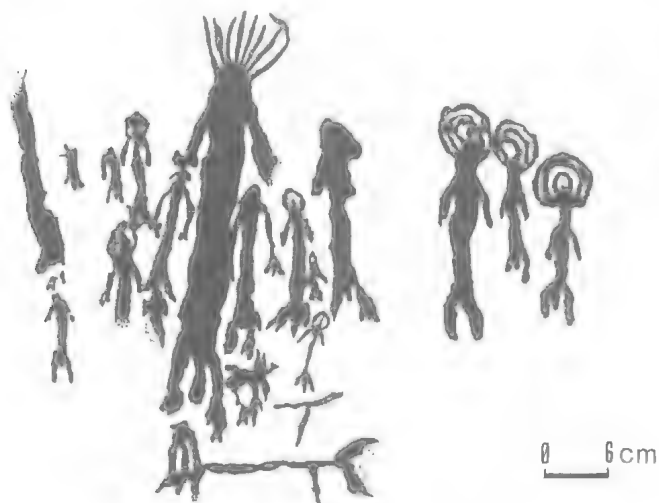


FIG. 74. Anthropomorphs with 'headdresses' of various geometric forms, Site DF8, Wardance Hill (after M. David, 1990, fig. 13).



FIG. 75. Anthropomorphs and a geometric non-figurative design, Site DT8, Mt Carbine (after M. David, 1989, fig. 16).

THE ROCK ART OF NGARRABULLGAN

Thirteen rock art sites have been recorded from Ngarrabullgan (David, 1994). Two were located in rhyolite conglomerate overhangs near the base of the mountain, two occurred in sandstone overhangs along the cliff-line at the base, and nine were located in sandstone shelters at the top of the mountain.

Three rock art techniques were recorded: paintings, stencils and prints. Paintings predominate, accounting for 83.3% of the 222 pictures recorded (Table 65). The stencils consist of 25 red hand stencils and two red asymmetric boomerang stencils. The sizes of the hand stencils indicate that children, adult males and possibly adult females are represented, while the similarity of

the two boomerang stencils suggests that they may have been undertaken using the same boomerang (both stencils occur in the same cave) (David, 1991e). The hand prints are unusual in that 10 of the 11 prints consist of finger markings rather than well defined hand impressions. The finger markings occur as sets of four elongated pigment marks, similar to hand impressions, except that they have been created by dragging the fingers along the rock, whereas classic hand prints are hand impressions created by pressing the hand against the wall surface. Although finger marks are more common here than classic prints, neither are predominant in this area.

PAINTINGS

The principle colours used at Ngarrabullgan are red and white, although yellow, brown and orange are also present (Table 66). Most of the art is monochrome (96.8%). Eight bichrome paintings were also recorded (in white outline/red infill and red outline/white infill). Two of the bichrome paintings have dotted outlines, a feature rarely noticed from surrounding sub-regions.

The most common motifs are non-figurative in form (84.9%), most of which are grid, geometric or other linear designs (Table 67, Fig. 77). Figurative images account for 9.2% of paintings. The anthropomorphs, in particular, are reminiscent of those from Bonny Glen Station and the Mitchell-Palmer limestone zone to the north, in that they have generalised body shapes devoid of internal decorations. All anthropomorphs are monochrome infilled, and the majority of them are white (53.3%) and painted vertically (60.0%) (Table 68).

ANTIQUITY

IMPRESSIONS BASED ON SUPERIMPOSITIONS AND DEGREES OF WEATHERING

Little is known about the antiquity of Ngarrabullgan's rock art. In 1967, Ron Edwards, a local rock art enthusiast, published a two-page report on the rock paintings he saw at Ngarrabullgan. He recorded rock art at eight sites, none of which have yet been relocated. Although his recordings were impressionistic rather than systematic, he noted that most of the paintings at Ngarrabullgan were non-figurative in form, but that '*there were six... recent designs*' at his site S81, '*mainly of human figures*' (Edwards, 1967: 7). '*At sites S80-S82, the recent*



FIG. 76. Site 1, Bare Hill (after Clegg, pers. comm. 1991).

figures ... are in marked contrast to the older designs, and have nothing in common with them either in motif or application.

They have been executed in hastily applied ant-bed, mixed to a slurry with water and applied by smearing on a handful at a time' (Edwards, 1967: 7).

It is worthwhile to note that we only became aware of Edwards' report after completion of our analysis of the Ngarrabullgan material. Yet one of the impressions which we had also gained was that nearly all of the anthropomorphs we had recorded had a fresh appearance. These included two human forms painted in brown mud, two in red, and one in white pigment. It is therefore interesting to note that Edwards' impressions were similar to ours, in the sense that he argued that the anthropomorphs appeared to be relatively recent. These conclusions were reached from observations of superimpositions and degrees of weathering.

STRATIFIED PIGMENTS

The only hint of the art's absolute age comes from the presence of stratified pigments in the two excavations undertaken. At Initiation Cave,

pigments appear in the archaeological deposits at the same time as occupation, around 4,100BP. At Ngarrabullgan Cave, there is a nine-fold increase in the number of ochre fragments recovered after 5,400BP, and a 375-fold increase by weight. All of the use-worn pieces come from mid to late Holocene times.

DISCUSSION

In terms of motif forms, the rock art of Ngarrabullgan is very different to that of subregions located to the immediate east, north and northwest. There are proportionally far fewer figurative images at Ngarrabullgan, where cave paintings are predominantly non-figurative linear designs. This sets Ngarrabullgan apart from Princess Charlotte Bay and the Flinders

Island group, the Koolburra Plateau, Laura, the Mitchell-Palmer, Bonny Glen Station and Bare Hill. Like the paintings from these subregions, however, the Ngarrabullgan paintings probably also date mainly to mid to late Holocene times, although here the evidence relies entirely on the distribution of stratified ochres in the excavated sites. It is possible that the figurative designs are relatively recent in age.

THE ROCK ART OF THE ROOKWOOD-MUNGANA- CHILLAGOE LIMESTONE BELT AND OOTAN

THE ROOKWOOD-MUNGANA-CHILLAGOE LIMESTONE BELT

The Rookwood-Mungana-Chillagoe limestone belt is 50km southwest of Ngarrabullgan. Systematic surveys of 25.2% of the limestone zone for rock art sites, revealed 40 sites (David, 1994). They contained 667 cave paintings, 54 stencils, 59 peckings, nine poundings and five composite



FIG. 77. Painted grid motifs, Ngarrabullgan.

pictures, including rock art from all parts of the limestone belt. In addition, abraded grooves (single grooves, sets of grooves and amorphous scratched areas) were also recorded (Fig. 78). We have not included the latter in the following analysis, however, as they may also have been related to economic activities, such as tool sharpening. Although the limestone belt is more or less continuous, for the purposes of this work the surveys were undertaken in three sections: Rookwood Station, Mungana and Chillagoe (Fig. 79).

ROOKWOOD STATION

Rookwood Station is located towards the northern end of the Rookwood-Mungana-Chillagoe limestone belt, and contains some of the largest tower karsts in the region. Eight rock art sites, containing 51 pictures, were recorded from this area. Most of the rock art consists of paintings (62.7%), although peckings, poundings and stencils are also present (Table 69). As the sample size is small, the results should be used with caution.

Paintings. The paintings are principally monochrome linear designs. Bichrome paintings are also present, consisting principally of outlined

and infilled designs. There are no internally decorated paintings. Red, white and black are the principle colours used (Table 70).



FIG. 78. Abraded grooves, Rookwood-Mungana-Chillagoe limestone belt.

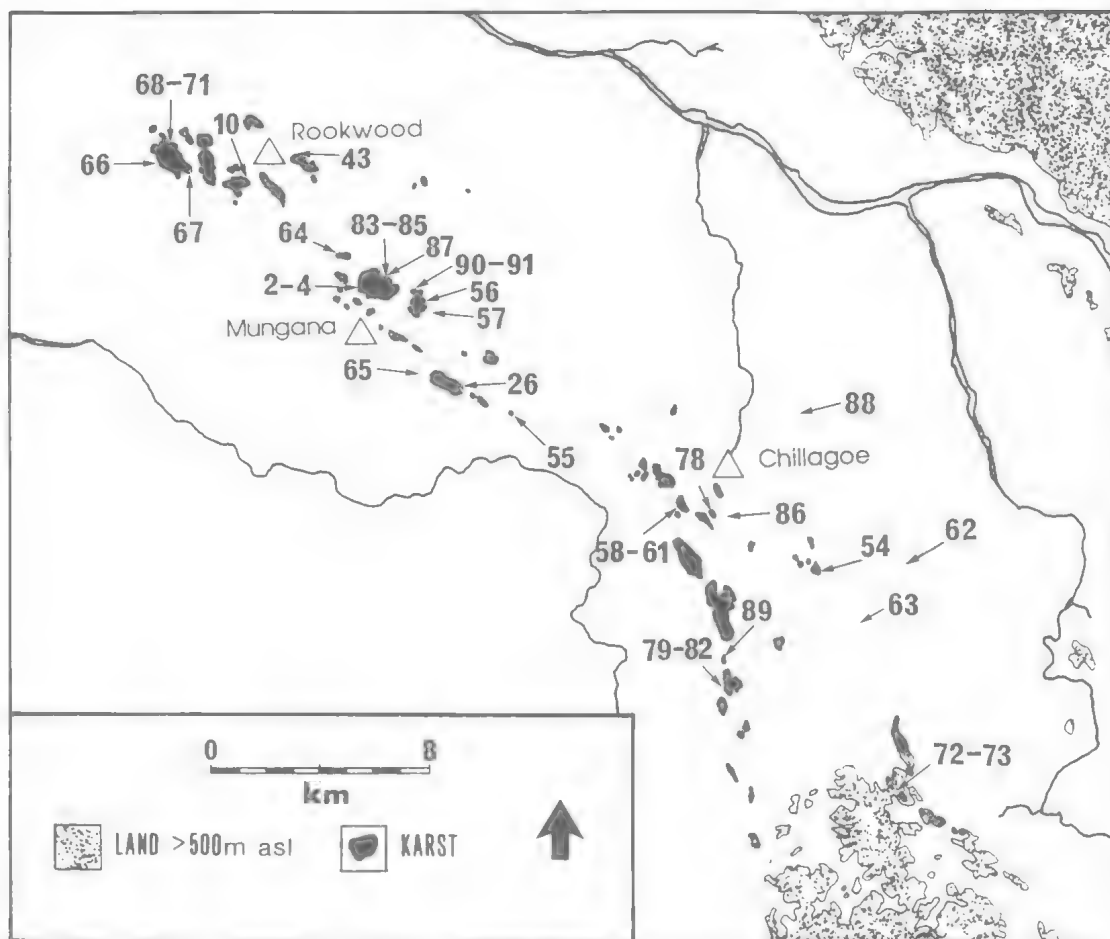


FIG. 79. The Rookwood-Mungana-Chillagoe limestone belt, showing locations of sites recorded.

The Rookwood Station paintings are principally non-figurative and track designs (68.8% and 28.1% of paintings respectively), with significant proportions of the non-figurative forms consisting of grid, radiating and geometric shapes (Fig. 80). Single lines (straight or curved) and circles are relatively common. Most of the paintings consist of a series of distinct lines joined together to form linear sets, although three paintings are infilled designs. Figurative designs are also present, but they are not common (3.1% of paintings) (Table 71).

Other Techniques. Other techniques are peckings, poundings and stencils. The two pounded pictures consist of sets of shallow, round pits, whereas the peckings are deeper and exhibit a broader range of forms (Table 72). The stencils are of hands, none of which exhibit any evidence of mutilation or finger bending. One unidentified



FIG. 80. Non-figurative painting (radiating design), Rookwood Station.

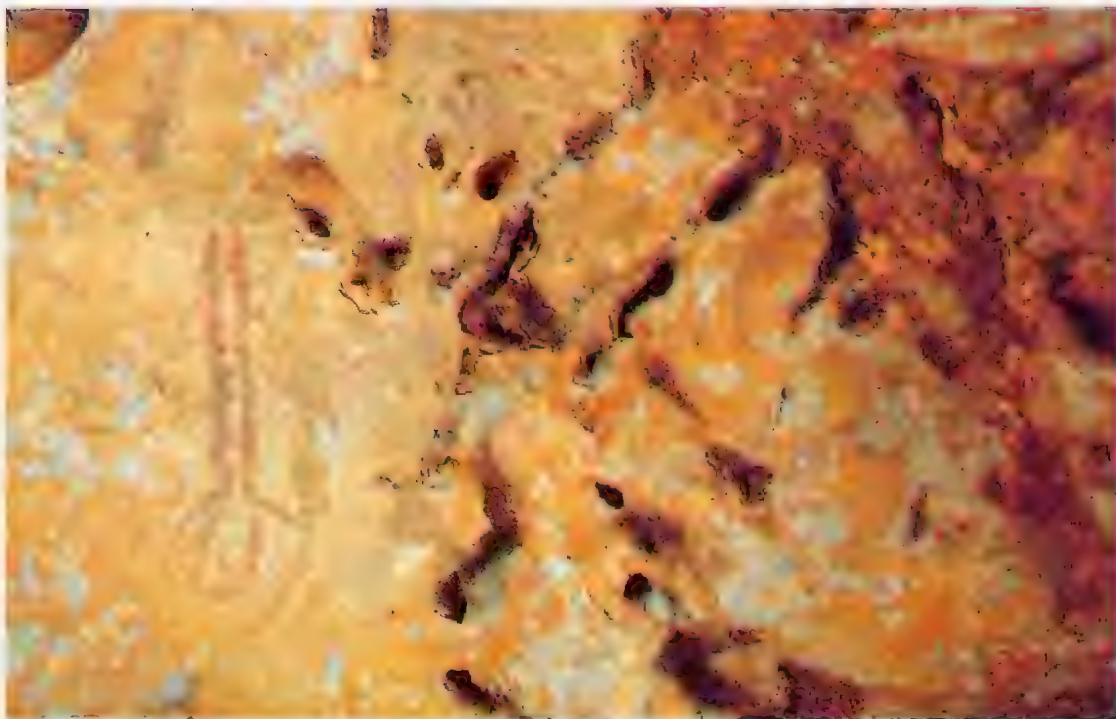


FIG. 81. Non-figurative paintings, Mungana.

circular object has also been stencilled, and all of the stencils are coloured red.

MUNGANA

The Mungana area is located near the centre of the limestone belt. Fifteen sites and 286 rock pictures were recorded, most of which are paintings (80.8% of pictures) or stencils (14.0%). Peckings, poundings and composite designs were also recorded (Table 73).

Paintings. The majority of paintings are monochrome linear designs, many of which are geometric (38.5%), grid (27.3%) or radiating (7.4%) forms (Tables 74, 75, Figs 81, 83). This is reminiscent of the paintings at Rookwood Station. Figurative designs are rare, accounting for 3.9% of paintings (Figs 84, 85). The principle colours used are red, white and black, again closely following the distributions evident at Rookwood Station (Table 75).

Other Techniques. Stencils account for 14.0% of Mungana's rock art. Of the 40 hand stencils recorded, three are hand variants (mutilated hands or hands with bent fingers). One depiction is of a fist, and the other two have missing fingers.

Both peckings and poundings occur here, although they are rare (as was also the case at



FIG. 82. Non-figurative paintings, Mungana.



FIG. 83. Non-figurative painting, Mungana.

Rookwood Station). All pounded designs are sets of shallow pits, whereas the peckings consist of a single set of radiating lines and eight bird tracks (Figs 86, 87). The composite designs include one stencilled boomerang which has subsequently been infilled by freehand painting, and one geometric painting further embellished by a series of short abraded grooves.

CHILLAGOE

Seventeen rock art sites and 461 pictures were identified and recorded from the Chillagoe area, where the overall impression is of a body of rock

art identical to those of Mungana and Rookwood Station. As with the latter areas, the most common technique is painting (87.6% of rock pictures), although other techniques are also found (Table 76).

Paintings. Most of the cave paintings of the Chillagoe area are non-figurative in form. Geometric, grid, radiating and other linear designs together account for 88.4% of the paintings, whereas only 1.2% are figurative (Table 77, Figs 88, 93). These proportions are comparable to those of Mungana and Rookwood Station. The colours used are also similar, although here black is slightly less common than it is to the immediate north (Table 78). The overall impression is thus confirmed by the quantitative data — that the Rookwood-Mungana-Chillagoe region constitutes a single stylistic zone dominated by non-figurative paintings of linear forms.

Other Techniques. The section of Chillagoe limestones which has been surveyed revealed only two hand stencils, both of which were undertaken in red. Pounded designs include three sets of shallow pits, one anthropomorph, two double arcs and one curvilinear maze. Peckings include non-figurative as well as track designs (Table 79; Fig. 94). The two composite designs consist of painted radiating figures with short abraded grooves, and a painted

line also containing a series of abraded grooves perpendicular to the figure's length.

ROOKWOOD-MUNGANA-CHILLAGOE: ANTIQUITY OF THE ROCK ART

As was the case for other subregions, our understanding of the antiquity of the rock art of the Rookwood-Mungana-Chillagoe limestone belt relies almost exclusively on circumstantial evidence. Nevertheless, the temporal pattern that is emerging is consistent with the trends observed from other areas. The data for this are described below.



FIG. 84. Painted anthropomorph, Mungana.

Patination and Weathering. Two sets of engravings are clearly distinguishable:

1, highly patinated peckings of non-figurative and track forms. These are dominated by circles and circle variants, radiating designs, single lines, sets of lines, tridents and bird tracks;

2, unpatinated poundings of shallow pits.

The only moderately patinated engravings observed come from Boundary Shelter (Site 89) (a curvilinear maze, an anthropomorph and two double arcs, all of which are pounded), and Walkunder Arch Cave (a radiating non-figurative pecking). The highly patinated nature of the great majority of pecked figures implies that they may be very old (but see Dragovich 1981, 1984, 1986, 1987).

Superimpositions. No clear trends have been identified in the superimpositions (Tables 80, 81). One set of unpatinated pounded pits overlies



FIG. 85. Weathered turtle painting, Mungana. Scale in cm.

a red painted line, and this is the only known example of an engraving in superimposition with

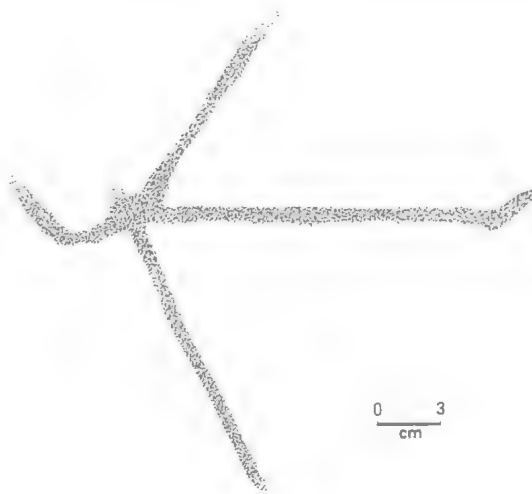


FIG. 86. Pecked and heavily patinated non-figurative (radiating) design, Fern Cave, Mungana.

a painting (Fig. 95). No peckings occur in superimposition with pigment art.

Stratified Pigments. Archaeological excavations at Echidna's Rest have revealed that ochre deposition rates peak during the late Holocene. A similar trend is evident from Fern Cave, although here the entire Holocene sequence is contained within two XUs, making it difficult to determine the timing of the Holocene changes. Nevertheless, at Fern Cave this increase is accompanied by decreases in the deposition rates of all other cultural materials, implying that artistic activities increased at a time when all other occupational activities diminished. This implies that, at this site at least, increases in artistic activity (occurring sometime during the Holocene) did not reflect overall increases in occupational intensities. Given the evidence from Echidna's Rest and Walkunder Arch Cave, where similar changes have been dated to c.3,000BP and 3,700BP respectively, it is likely that the reported increases in painting activity during the late Holocene reflect systemic changes throughout the Rookwood-Mungana-Chillagoe sub-region.

White Pigments and Dog Tracks. Between 29% and 54% of paintings from each of the three parts of the Rookwood-Mungana-Chillagoe sub-region were undertaken in the unstable white pigment, kaolinite. Coupled with the presence of a number of dingo tracks, this implies that a significant number of paintings probably date to relatively recent times (Fig. 93).

AMS Date. A single AMS date has been obtained from a charcoal drawing near Chillagoe (from the Racecourse Site [CM59]). It is a faded, black line drawing of indeterminate but non-figurative form. Superimposed on it are a series of subparallel, mauve lines (drawn), white lines (painted), and a bichrome white and red non-figurative painting (Fig. 96). These drawings and paintings are typical of the site as well as of the



FIG. 87. Pecked and heavily patinated bird track, Fern Cave, Mungana.

Rookwood-Mungana-Chillagoe subregion in general.

There are 33 paintings and drawings at the Racecourse Site, including seven charcoal drawings similar in form to (and including) the one dated, 21 other linear drawings consisting of sets of subparallel lines (some of which also contain perpendicular lines forming grids) (mainly drawn or painted in monochrome red, mauve or white), three bird and one macropod tracks, and one bichrome (white outlined, mauve infilled) non-figurative design. In short, the paintings at the site



are predominantly linear, non-figurative motifs, as is typical of the area in general.

A small amount of charcoal was scraped with a sterile blade from the charcoal drawing and immediately placed in a sterile plastic bag. There was no evidence of calcium carbonate above the charcoal. The sample was submitted to the NWG Macintosh Centre for Quaternary Dating (University of Sydney), who sent it to the Institute of Geological and Nuclear Sciences (New Zealand) for dating. A radiocarbon determination of $2,056 \pm 81$ BP (R 18075/2, NZA 2738) was obtained. As $\delta^{13}\text{C}$ was -24.9‰ , it was unlikely to have been contaminated by carbon from the limestone wall. There are no reasons to doubt the age obtained and, consequently, it is taken to date the drawing. The paintings superimposed over it are therefore younger, although it is not known by how much. Given the similarity of the other paintings in the site, it is possible that they also date to the same general period of time. Further radiocarbon dates, however, are needed to test this proposition.

FIG. 88. Non-figurative painting (radiating design), Chillagoe.



FIG. 89. Non-figurative paintings, Chillagoe.



FIG. 90. Non-figurative painting, Chillagoe. Scale in cm.



FIG. 91. Non-figurative paintings, Chillagoe.

DISCUSSION

The Rookwood-Mungana-Chillagoe limestone belt is characterised by a relatively homogeneous body of rock art. Monochrome, non-figurative paintings predominate in every area surveyed, with geometric designs such as circles and single lines, radiating sun-bursts, sets of parallel and intersecting lines and other linear designs being the most common forms. Individual motif types — with the significant exception of radiating lines, circles, single lines and grid motifs — rarely occur more than once, and therefore the range of non-figurative designs can be said to be broad (see David & David [1988] for a fuller, visual presentation of motif forms). Despite this, artistic conventions appear to be highly formalised, in the sense that most pictures are highly linear, and many consist of sets of intersecting lines (but note that no squares, triangles or rectangles have been recorded). These characteristics are highly reminiscent of the art of Ngarrabullgan to the north.

Figurative designs are very rare, and no faunal category has been observed from any two parts of the limestone zone surveyed. For instance, two painted snakes were recorded from Mungana (the central section of the limestone belt), but none have been found at Chillagoe (to the south) or Rookwood (to the north). Similarly, two painted lizards were recorded from the Chillagoe area, but none were found in the other two areas. Given the small numbers of paintings involved, this may be pure coincidence, but this point is worth keeping in mind as the sample size increases. Given the conspicuous absence of some faunal types — most notably macropods — from the rock art of the Mitchell-Palmer subregion to the north, it is possible that the restricted geographical distribution of snake, lizard and other zoomorphous paintings in the Rookwood-Mungana-Chillagoe area is meaningful. Unfortunately, however, the predominance of non-figurative motifs in this



FIG. 92. Echidna painting, Chillagoe. Scale in cm.

region makes it rather more difficult to adequately address this issue.

The principal colours used are red (26.1%), white (47.2%) and black (14.2%), with most paintings undertaken in monochrome. The significant contribution of white and black monochrome paintings is characteristic of the Rookwood-Mungana-Chillagoe rock art.

As was the case for the rock art of other parts of southeast Cape York Peninsula, the art of the Rookwood-Mungana-Chillagoe limestone belt has proved to be difficult to date. There is a dearth of appropriate data on the antiquity of rock pictures in the area. This is compounded by the absence of distinct artistic styles in the area, that

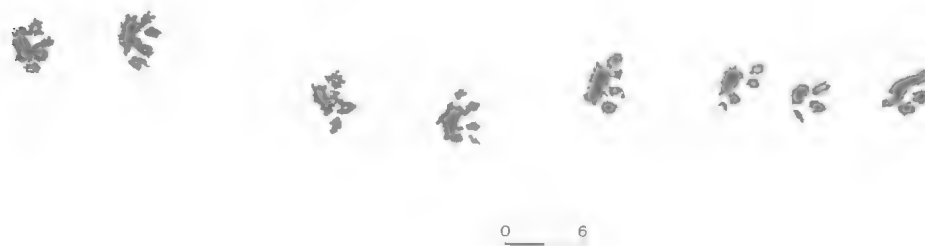


FIG. 93. Dog track paintings, Chillagoe.



FIG. 94. Patinated, pecked non-figurative design, Chillagoe.

would have otherwise enabled a differentiation of artistic conventions through time. Because of this, the chronological framework relies almost entirely on a separation of, on the one hand, an early tradition dominated by patinated peckings of non-figurative and track forms, and, on the other, a later painting tradition of similar forms. Shallow, pounded pits may be a very recent innovation.

Both the AMS date and the distribution of stratified pigments suggest that many of the paintings may date to mid to late Holocene times ($< c.3,000BP$). However, this is only a gross estimate based on a small data-base. Nevertheless, the numerous white paintings and the presence of painted dingo tracks offer support for this broad temporal model.

OOTAN

The township of Ootan is located around 20km south of Chillagoe. The area is characterised by sclerophyll woodlands on boulder-strewn hills and undulating plains. The granite boulders are found at all topographic levels from creek bed to hill top, although they tend to be more numerous in the former. Many of the boulders are extremely large, at times reaching over 20m in maximum

diameter. It is under their overhangs that rock-shelters are found, some of which contain rock art.

Four rock art sites have been recorded from the area (David, 1994). All of the art consists of paintings. It is difficult to judge whether this is a function of sample size, or whether the absence of other techniques, especially stencils, is a true indication of the area's artistic practices. While the hard granite surfaces are not conducive to engraving, this would not affect stencilling. Investigations of these issues, however, are beyond the scope of the current work.

Eighty two paintings were recorded from the Ootan granites. All paintings are monochrome, and most are linear designs showing little evidence of area infilling (Fig. 97). The only colours present are red, white and black (Table 82). Two of the paintings are anthropomorphs, 15 are bird tracks, and the rest ($N=65$) are non-figurative designs. The non-figurative motifs include geometric, grid, radiating and other linear designs reminiscent of those from Ngarrabullgan and the limestone belt to the north (Table 83). Indeed, the Ootan paintings would not be out of place amongst those of Ngarrabullgan or the Rookwood-Mungana-Chillagoe limestone belt. Circles, star-bursts, single lines and sets of par-

parallel and intersecting lines (grids) are the most common design forms, although here too the range of motif forms is very broad. Given the presence of significant numbers of white paintings (31.3%), and the fact that the rock walls of all of the painted rockshelters show evidence of deterioration (granular disintegration and block collapse), these paintings are unlikely to be of great antiquity.

SPATIO-TEMPORAL TRENDS IN THE ROCK ART OF SOUTHEAST CAPE YORK PENINSULA

Maynard (1976, 1977) noted that a general pattern of change could be identified in Australia's rock art. Following Edwards (1966, 1971), she argued that there existed an early and widespread distribution of pecked engravings, consisting almost entirely of non-figurative and track forms, followed by regionally distinctive figurative together with non-figurative art forms during more recent times. To Maynard (1977: 106), the early art reflected a single, relatively time-bound tradition, indicating the existence of an early, pan-Australian cultural system (but see Franklin, 1988, 1992). She named this artistic tradition the Panaramitee, after a pecking site containing motifs in proportions typical of the arid and semi-arid zone in general.

Maynard's observations have generated considerable debate among Australian rock art specialists (e.g. Clegg, 1988; David, 1988a, 1988b; Franklin, 1988, 1992; McDonald, 1988; McCarthy, 1988; Rosenfeld, 1991). As Franklin (1988) noted, the concept of the Panaramitee emerged as a means of situating a body of rock art, consisting of '*a homogeneous style of engravings, which occurs throughout the continent ... which reveals some regional variation in its more frequent motifs*' (Franklin, 1992: 28), within a broad chronological framework. More recently, Franklin's detailed analysis of rock engravings from various parts of Australia has highlighted the broad similarities between the patinated peckings of many parts of Australia, although some regional differences have also been shown to exist.

Perhaps more so than with any other aspect of archaeology, rock art specialists are faced with a problem that severely limits the analytical potential of their data. This is the tyranny of time. The rock engravings reported by both Maynard and Franklin have been poorly dated, covering a



Fig. 95. Unpatinated pounded pits superimposed over a painted red line, Chillagoe.

potential time span of over 40,000 years. What meaning has the statement that the rock art of one region is similar to that of another region, if the data presented cover so vast a period of prehistory? During this time, it is possible that changing conventions were amalgamated, thus reducing the chance of detecting spatio-temporal patterns. This is a problem that both Maynard and Franklin recognised.

The conclusion reached by Maynard — that Australia's earliest rock art consisted of a relatively homogeneous body of non-figurative and track forms — was thus based on coarse-scaled spatial and temporal data. For example, southeast Cape York Peninsula was represented by only one of the subregions discussed herein (Laura River). Similarly, Franklin's analysis was based on comparisons of broad areas, with Cape York Peninsula being solely represented by Maynard's Laura River and Flood's Koolburra Plateau data.



FIG. 96. The painted panel, Racecourse Site, Chillagoe. The maximum length of the bichrome painting is 57cm.



FIG. 97. Non-figurative paintings, Ootman.

Consequently, their conclusions must be viewed with these limitations in mind.

Our approach differs from those of Maynard and Franklin. We began by sub-dividing southeast Cape York Peninsula into 19 smaller subregions. We will now compare and contrast their rock art within broad time frames. There is, therefore, a fundamental difference in the scales of analysis employed in these three works. Given that our aims are to undertake detailed spatio-temporal investigations of southeast Cape York Peninsula, we would argue that it is best to divide the region into a number of subsections, and to compare and contrast these to each other and to other adjacent regions. An alternative, general comparison of southeast Cape York Peninsula with other regions, would be too broad and coarse-grained an approach for our purposes.

SPATIO-TEMPORAL PATTERNS

We now briefly summarise trends mentioned above, followed by multivariate statistical analyses of the region's rock art.

TEMPORAL TRENDS

The rock art described above potentially represents at least 40,000 years of Aboriginal prehistory. Consequently, as far as past human behaviour is concerned, any comparison of the rock art of given areas is of little value, unless one can demonstrate the specific periods of time involved. Without knowing the time frames, it is difficult to relate the emergent patterns to the activities of people in prehistory. For example, the patterns may represent time-specific insignia, or simply amalgamations of numerous patterns whose sums have resulted in new, synchronic ones.

In her detailed analysis of the Laura art, Cole (1988) found that while superimpositions involving engravings and paintings were rare, the latter overlay engravings in all cases but one. Similarly, Flood (1987, table 3) did not identify any pecking superimposed over a painting in the Koolburra Plateau. In the Rookwood-Mungana-Chillagoe limestone belt no pecking overlay paintings, although one unpatinated, shallow set of pounded pits, of a form thought to be very recent in age, was recorded overlying a painting (David, 1988b). In all subregions, peckings therefore seem to be older than paintings, although some overlap has also been noted. In the Chillagoe region, there may have been a total abandonment of pecked art, followed by more recent shallow pounded pit forms.

The apparent early age of the region's peckings is given support by their generally patinated nature, although in some areas (and especially at Laura and the Koolburra Plateau) unpatinated forms are also present. This is consistent with the pattern of superimposition. At the Amphitheatre Site, a pecked dingo on a rock platform in open surroundings adds further support for relatively recent peckings, but this is the only such case from all of the areas studied. The conventions used in this instance are reminiscent of the local paintings.

While it appears that at Laura and the Koolburra Plateau peckings continue from pre-13,000BP to post-4,000-3,500BP times, this continuity may not be typical of the broader region, as there is evidence that much of the pecked art probably dates to pre-mid Holocene times. Even in the Laura and Koolburra Plateau subregions, most of the peckings probably date to relatively early times. For example, at Green Ant Rockshelter, 1,500BP sediments cover a panel of non-figurative peckings, indicating that they must be older than this. At the Early Man Rockshelter, 13,000BP deposits similarly cover non-figurative peckings. It may be of interest to note also that at all excavated sites containing peckings, early Holocene or late Pleistocene occupational deposits have been found. The implication of this is that occupation sites containing peckings are likely to date to relatively early times. This is not the case with the paintings.

Although it is likely that some rock paintings also date to early times, the pattern of superimpositions and the distribution of stratified ochres from excavated sites suggests that most of the paintings are more recent than peckings. A dramatic increase in painting and stenciling after 3,000-2,000 BP is implied by the vertical distribution of pigments in the excavated deposits of Early Man, Echidna's Rest, Green Ant, Yam Camp and Sandy Creek 1. At Initiation Cave and Ngarrabullgan Cave, similar increases begin around 5,000-4,000BP. Because a number of the above excavated rockshelters contain extensively painted galleries, and because the excavated squares were located immediately beneath them, it is likely that much of the stratified pigment recovered in such contexts relates to the rock art.

The pattern of ochre deposition at Fern Cave does not reflect overall occupational trends, indicating that its distribution may not be related to these. Whereas occupation is most intensive during the late Pleistocene, ochre deposits peak sometime during the Holocene. This adds support

to the view that the increases in painting activity documented during the mid to late Holocene at other sites, may reflect broad, regional changes rather than site-specific ones. Extensively painted panels at Mordor Cave, Endaen Shelter and the Princess Charlotte Bay sites offer further support for this, because in each case both occupation and painting activity began during the mid to late Holocene. The only direct dates available come from Chillagoe and Laura, where AMS determinations of $2,056 \pm 81$ BP, 730 ± 75 BP and 725 ± 111 BP were obtained. The first of these radiocarbon dates is superimposed by a number of paintings that are typical of those found in the Rookwood-Mungana-Chillagoe area.

GENERAL SPATIAL TRENDS

A number of obvious patterns emerged from the above observations:

- 1, in all areas except for the Koolburra Plateau, stencils and/or prints are either less abundant than paintings or totally absent. Paintings and engravings predominate, although linear, abraded grooves are relatively common in the limestone zones.

- 2, peckings from all areas are generally of non-figurative or track forms. Many of these are heavily patinated. These have been inferred to date to relatively early times.

- 3, the great majority of rock paintings found north of the Mitchell River are figurative. At Princess Charlotte Bay and the Flinders Island group, they are principally moths/butterflies and zoomorphs with crescent heads. The sandstone belt around Laura contains a broad suite of zoomorphs and anthropomorphs, while the Koolburra Plateau to the immediate west contains a large number of echidna-human forms. To the east, the rock art of Bonny Glen Station and Mt Windsor/Mt Carbine is reminiscent of the Mitchell-Palmer limestone belt, where infilled monochrome anthropomorphs predominate. The situation is very different to the south, where non-figurative forms predominate.

- 4, Quinkans (anthropomorphs containing a suite of unusual traits) are characteristic of the Laura area. Rare cases have been found as far south as the Mitchell River (Fig. 98), but none have been documented further south. Their distribution is associated with the northern, figurative painting tradition mentioned above.

- 5, while the peckings are relatively homogeneous throughout southeast Cape York Peninsula, the paintings appear to be regionalised within a broad, two-fold north/south division.

These patterns are further explored below.

THE STATISTICS

The statistical analyses undertaken here are based on multivariate techniques. The reason for this is that our aims are not so much to trace the distributions of single motif forms, colours or other artistic conventions, but to investigate the similarities and differences in the subregional assemblages through time. Each such assemblage is made up of an aggregate of variables, and it is these multivariate assemblages that we wish to compare and contrast.

Any statistical analysis of more than a descriptive nature is predicated on certain assumptions about the substantive and distributional nature of underlying raw data. From the start, there is the question of the representative nature of the data: is it in any sense close to the random sample assumption at the heart of statistical sampling? Put another way, is the data set plausibly just one of a larger set of possible samples forming a statistical population, each such sample being equally likely to be chosen by the researcher. Alternatively, is the data to hand the population itself, with no further samples ever being available. The truth probably lies in between; the data set used here is a sample (rather than the population), in the sense that further fieldwork would provide further data. It may be close to a random sample, if we feel that discovery in fieldwork is a random phenomenon. Alternatively, there may be a substantial systematic effect present in the sampling. Because of this, it is assumed, rather than shown, that the data presented in this section of this work are representative of the various sub-regions analysed. This assumption will not be tested here.

The descriptive statistics for the attributes analysed are presented in Appendix B for both weighted and unweighted analysis (that is, minimum, maximum, mean and standard deviation for each set of variables analysed). The weighted analysis takes into account the number of observations used in calculating percentages, while the unweighted does not.

Once there is agreement on the substantive nature of the sample (that is, how representative and hypothetically replicable it is), distributional problems arise. Should the analyses be weighted or unweighted? The weighted analyses favour those sites where many observations were taken. If the number of observations taken reflect the population distribution of the attribute in question, then weighted analysis is appropriate. However, if the number of observations taken is, at

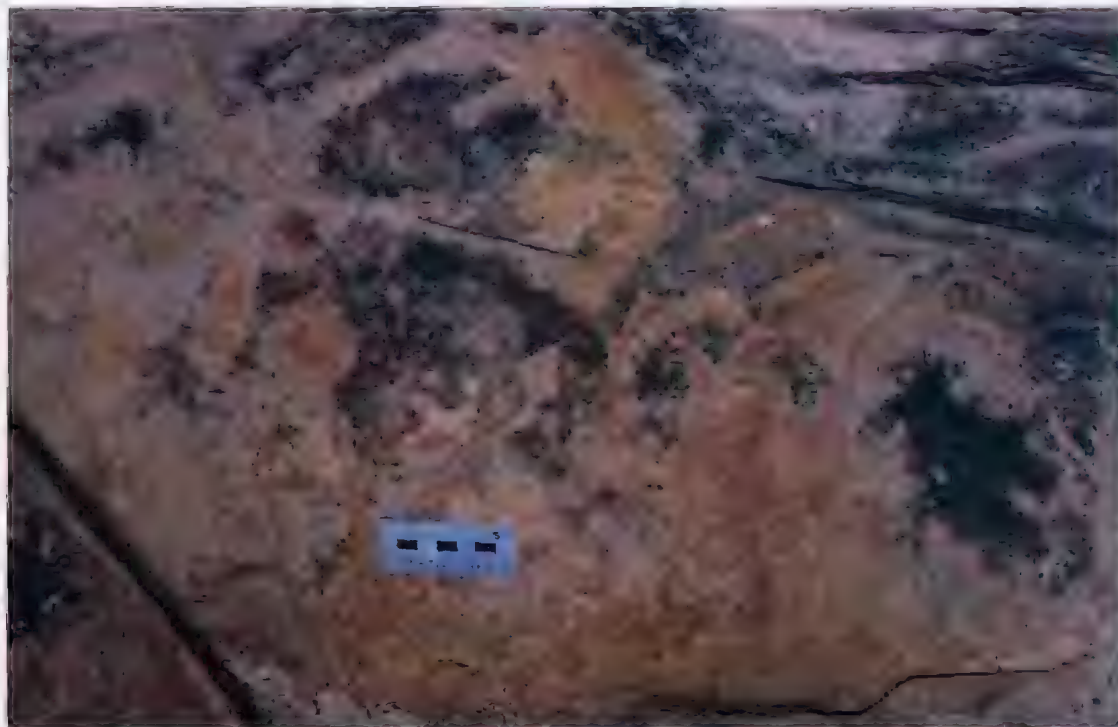


FIG. 98. The southern-most known Quinkan paintings, Mitchell River. There are 2 faded, painted Quinkans in this site.

least in part, a reflection of the availability to the researcher (or ease of collection) of the attribute, then the weighted analysis favours the happenstance of fieldwork rather than the underlying incidence of the attribute. Given that a number of surveying strategies were used to collect the various subregional sample sets, the data have not been weighted, even though the data were in all cases collected systematically.

At the next level, the nature of the formal statistical analyses of weighted or unweighted data depends on the mathematical nature of the sample data. Is the sample reasonably consistent with normality? Is variation within a given subregion fairly constant? Clearly, this is not the case. The percentage distributions have variability dependent on magnitude (formally, the variance is a function of the mean). The distribution of any one aspect of an attribute (for example, any one colour) contains outliers (observations discrepant from the body of the data) which nullify the usual inferences derived from statistical analysis. Nevertheless, the outliers are valid, substantively interesting outcomes; there is no sense in removing them from the data base. Furthermore, applying statistical analysis of variance (ANOVA) to

the variables used to generate a set of clusters is frowned upon, as, essentially, the ANOVA capitalises to a misleading extent on the clustering process (capitalising on chance) (Aldenderfer & Blashfield, 1984: 64-65). Because of these issues, the following analyses have been restricted to the mapping processes of MDS and cluster analysis, which do not depend on formal statistical modelling. Before discussing these methods, we outline the variables analysed by them.

THE VARIABLES

The peckings and paintings can be largely taken to reflect broad but largely exclusive time frames. Although this temporal framework is coarse grained and by no means exact, it is taken as the starting point for the following analysis. This chronological model is largely based on circumstantial data, and as such requires testing.

Our original intention was to compare the design elements of each picture, hence eliminating the need to differentiate between figurative and non-figurative forms. A general absence of appropriate data, however, has prevented such an investigation from being carried out. For a similar

reason, picture sizes were also not analysed. Consequently, the multivariate analyses undertaken rely largely (but not exclusively) on overall attributes of form. Five sets of variables have thus been analysed. In each case, the rock art of each region is first standardised by converting the raw data into percentages. It is on this basis that the various subregions are compared. This standardisation was necessary in order to eliminate the effects of differential sample sizes. It is a valid statistical procedure that allows the creation of comparative sample formats by which the rock art of the various subregions can be related to each other via multivariate analysis. Given that all of the data presented here were collected systematically, it is assumed that the data are representative of the various subregions analysed. This assumption will not be tested here. The variables are briefly described below.

Figurative, Non-figurative and Track Forms. The first analysis undertaken compares proportions of figurative, track and non-figurative designs. These are geared to a broad characterisation of subregional motif forms.

Specific Motif Forms. The patterns obtained from the above analysis are further explored by differentiating the rock art into more specific forms. Faunal categories (including animal tracks) are identified where possible, and non-figurative designs are subdivided into recurrent themes. The aims of this analysis are to further investigate the various formal conventions used in the different subregions.

Linear Figures, Outlining, Infilling and Internal Decorations. In this test, the use of line and space is analysed with respect to proportions of linear, infilled and internally decorated pictures. Various combinations are also identified. The aims of this analysis are to determine spatial patterning in the artistic conventions used in the creation of individual images. These variables are independent of motif forms.

Monochrome, Bichrome and Polychrome. The numbers of colours used in each painting are analysed here. Proportions of monochrome, bichrome and polychrome paintings are identified from each subregion.

Colours Used. The natural availability of colours within each subregion may have influenced the distribution of colours in the art. This will be taken into account when the statistical results are interpreted. Nevertheless, some colours are available throughout the region (e.g. black charcoal), and, in such cases, their use (or

lack of) cannot simply be attributed to differences in availability.

THE MULTIVARIATE STATISTICS: DESCRIPTIONS OF METHODS USED

The aims of the statistical analysis are to determine the statistical relationship of each subregion, by treating each variable as a discrete data set. To do this, a measure of the dissimilarities (or distances) between the subregions is established for each attribute of interest (e.g. the colours used in the paintings). Kruskal & Wish (1978: 5, quoting Shepard, 1962) describe Multidimensional Scaling (MDS) as a '*set of mathematical techniques that enables a researcher to uncover the hidden structure of data bases*', a description that applies also to Cluster Analysis. MDS locates points (in our case, the subregions) in a spatial configuration or 'map'. Having located the subregions in multidimensional space, the hidden structure, or theoretical meaning of the spatial representation of the subregions, can be determined. The spatial representations in Cluster Analysis are either 1, a hierarchic tree-structure, called a dendrogram, showing the separation of dissimilar subregions and the closeness of similar ones, or 2, a given number of clusters of subregions that are as similar as possible within a cluster and as different as possible between clusters.

MEASURES OF DISSIMILARITY

This section draws extensively on Davison (1983: 2, 3, 85-87). MDS and Cluster Analysis are procedures for studying the structure of objects (subregions, in this case), specifically by estimating the parameters in, and assessing the fit of spatial distance models for, proximity data. Proximity is measured by dissimilarity, a concept analogous to distance, which makes three basic assumptions:

- 1, if two objects are identical, their dissimilarity is zero, and that if they differ, their dissimilarity is positive;

- 2, an object is identical to itself; and

- 3, an object *a* must be as dissimilar from an object *b* as *b* is from *a*.

The measures used to operationalise dissimilarity — such as Euclidean distance — satisfy these three conditions and usually satisfy a fourth condition called the triangle inequality, which states that the distance from object *a* to object *c* is at least the sum of the two distances between objects *a* and *b*, and objects *b* and *c*. These four conditions thus define a distance in

what mathematicians call a Metric Space, and dissimilarity is analogous to this concept.

The MDS plots and Cluster Analysis dendrograms presented in this study were obtained using SYSTAT statistical software (Wilkinson, 1990), employing Euclidean distance as the measure of dissimilarity, and Kruskal's Stress Formula 1 as the measure of fit (in MDS).

CO-ORDINATE SYSTEMS

Let X_{ik} and X_{jk} be the co-ordinate (in this instance, either a raw or derived score) of attribute k for sites i and j . The values of X_{ik} also vary with the two contexts in which they occur. These are:

1, in the first case, the co-ordinates represent the input data itself, that data being the percentage distribution of the attribute within a subregion. For example, the percentage distribution of the colour attribute across 19 colour combinations at Koolburra Plateau is 61.1 (red), 16.6 (white), 0.7 (black), ..., 0.0 (black and grey). The respective proportions at Jackass Station are 55.6, 9.3, 0.0, ..., 0.0 (Tables 41, 44).

2, within the MDS and clustering algorithms, the co-ordinates no longer represent the input data itself, but rather forms of standardised co-ordinates whose distances (in MDS) reproduce the rank order of the dissimilarities as closely as possible, and (in Cluster Analysis) are used in conjunction with a linkage method to form clusters of subregions.

DISSIMILARITY: EUCLIDEAN DISTANCE

The Euclidean distance d_{ij} between sites i and j is the root mean squared distance between the sites. For the example in 1, above, the Euclidean distance between Koolburra Plateau and Jackass Station is based on 19 colours and is given by

$$\sqrt{((61.1-55.6)^2 + (16.6-9.3)^2 + (0.7-0.0)^2 + \dots + (0.0-0.0)^2)/19} = \sqrt{(414.12/19)} = 4.67$$

FIT MEASURE: KRUSKAL'S STRESS FORMULA 1 IN MDS

Kruskal's MDS algorithm is used to estimate co-ordinates X_{ik} from data that, apart from sampling error, satisfy

$$\delta_{ij} = f(d_{ij}) = f\left(\left(\sum_k |X_{ik} - X_{jk}|^p\right)^{1/p}\right)$$

where $f()$ is any monotonic function and $p=2$ for Euclidean distance. Note that the d_{ij} , X_{ik} and X_{jk} are theoretical quantities, or parameters, to be

estimated in the distance model (they are no longer to be interpreted as the raw input scores and input dissimilarities). The δ_{ij} are the disparities, which are computed to be as near to the estimates of the d_{ij} as possible, subject to monotonicity and their reproducing the rank order of the input dissimilarities. Kruskal uses the distances d_{ij} and the disparities δ_{ij} to define various fit measures called stress; the final MDS co-ordinates (or configuration) correspond to the minimum stress.

The co-ordinates are standardised in SYSTAT so that the co-ordinate points sum to zero in each dimension, and hence are centred at the origin; and the sum of squares (or total variability) of all the co-ordinates equals the number of objects being scaled (not one, as stated in the SYSTAT manual). This latter standardisation permits assessment of the relative strengths accorded to the dimensions in terms of their contribution to the total variability. The measure used here is stress formula 1 (S_1), given by

$$S_1 = \left(\frac{\sum_{ij} (\delta_{ij} - d_{ij})^2}{\sum_{ij} d_{ij}^2} \right)^{1/2}$$

where the distances and disparities are now numerical estimates at any stage of the algorithm. Kruskal & Wish (1978) recommend against accepting solutions whose stress is above 0.1, and remark that it is seldom necessary to add dimensions beyond the number required to reduce the stress below 0.05. Thus, the question of dimensionality is reduced to whether the observed solution is essentially unidimensional (the x-axis in the plots), and to what interpretation to give the dimension, or whether the second dimension (the y-axis) is also interpretable. Table 84 presents the stress values for each of the analyses undertaken in this chapter. The analysis of specific motif forms (painted), with a stress factor of 0.11, is the only case where the stress factor is above 0.1, showing, in this case, that the two principal dimensions (x and y-axes) may not contain the full complement of significant variation. However, for consistency of interpretations, a two-dimensional solution has been retained.

LINKAGE IN CLUSTER ANALYSIS

As with the MDS, Cluster Analysis is also based on a similarity matrix that defines the relationship between units (the sub-regions). This

matrix is calculated by measuring the mathematical (Euclidean) distance between all pairs of subregions (Everitt, 1974: 15). Hierarchic clustering algorithms join or divide units (in our case, subregions) from clusters by a number of linkage methods (a non-technical discussion can be found in Aldenderfer & Blashfield [1984]; a mathematical treatment is given in Hartigan [1975]). The end product is a dendrogram showing successive fusions of subregions, where the more similar ones are grouped at a low level of the structure, and the more dissimilar ones are linked at progressively higher levels (Alvey et al., 1982: 123; Everitt, 1974: 8-9). The nested structure culminates where all subregions are in one group.

Three major types of dendrogram were created for this study, each depending on the type of linkage used:

- 1, single linkage, where links are based on distances between the nearest subregions from different clusters of subregions. This method focuses on items of greatest similarity, and produces long, drawn out clusters;

- 2, average linkage, where all subregions are used, and the linkages are computed from the average distances between all pairs of individuals (sub-regions) from different clusters of subregions. The compactness of the clusters tends to lie between single and complete linkage clusters; and

- 3, complete linkage, where the furthest distances between two subregions from different clusters are used. This method focuses on the subregions that contain the greatest difference. The method tends to produce compact clusters.

We have subjected the data to all three techniques (see below), but present the dendrograms of the average linkage Cluster Analyses only, as the results are similar in each case.

ANALYTICAL SCALES

One of the issues which has to be confronted before the analysis proceeds is the question of scale. For example, Layton (1992) has recently attempted a detailed comparative analysis of the rock art of Australia. Like Maynard (1976) and Franklin (1988, 1992) before him, his investigations were geared towards the recognition of broad, Australia-wide trends. The aims of the current work, on the other hand, have been different, beginning with the rock art of a smaller area (a single region) in order to obtain a better definition of temporal and spatial variations within it. We would thus argue that a detailed understanding of subregional conventions is criti-

cal to our understanding of the broader picture. It is on this basis that interregional comparisons can then proceed.

As Wright (1992: 128) noted, however, when undertaking multivariate statistics such as those employed here, it is necessary '*to introduce into the analysis specimens that are outside the range of any likely answer to the original question*'. To paraphrase Wright (1992: 128), there is always a nearest neighbour in the sort of analysis undertaken here. Unless one introduces samples from outside the region one is dealing with, it is difficult to evaluate the significance of the patterns produced because of a '*lack of perspective*' (Wright, 1992: 128). For instance, one of the obvious patterns which has already emerged is that the rock paintings of southeast Cape York Peninsula can be broken into two general spatial sets; a northern, predominantly figurative set, and a southern non-figurative. But would the introduction of data from a separate region, with different proportions of, say, track motifs, unite southeast Cape York Peninsula into a single group in the MDS map and the dendrograms? In this case, would southeast Cape York Peninsula continue to appear as a two-fold division, and would these subdivisions be distinct from surrounding areas?

To set the data from southeast Cape York Peninsula in a broader context, four other data sets, therefore, have been added to the multivariate statistics. These are all from regions located to the southwest of the study region — the White Mountains, Agate Creek, Lawn Hill and Mt. Isa. Unfortunately, no data sets were available from the north.

RESULTS OF THE MULTIVARIATE ANALYSES

THE EARLY (ENGRAVED) ART

Peckings are common throughout the sandstone zones located to the north and south of Chillagoe, but they are uncommon in the limestone belts and nonexistent in the granite ranges. This may well be due to the softness of the rock media, although this proposition cannot be tested here.

General Motif Forms: Figurative, Track and Non-Figurative Designs. Pecked motifs are predominantly of non-figurative and track designs in all of the areas surveyed. Nowhere do figurative designs account for more than 8.4% of peckings, implying considerable homogeneity in iconography (Table 85). The range of forms is

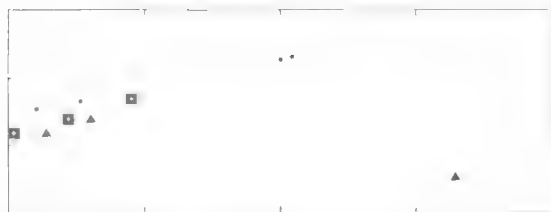


FIG. 99. MDS map for general motif forms (peckings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

relatively small, and there are no obvious spatial patterns in the distribution of general motif forms. This is well demonstrated in both the MDS map and in the dendrograms (Figs 99, 100). In the former, the major cluster of regional sets contains non-contiguous tracts of land, including all subregions except for the Laura River, the Koolburra Plateau and the Mungana limestone zone. This proximity of the various subregions on the MDS map occurs along both axes, implying considerable homogeneity in the proportions of formal conventions.

A similar pattern emerges in the Cluster Analysis, where, on the dendrograms, the Koolburra Plateau, Laura River and Mungana samples separate out as peripheral to the main set. It would be difficult, however, to determine the sig-

nificance of this separation, as the three subregions occur as outliers rather than as a concrete cluster of contiguous subregions. Such outliers can be expected in any MDS statistic or Cluster Analysis. As far as general motif forms are concerned, among the peckings, there is no clear clustering of contiguous regional sets.

Specific Motif Forms. The non-clustered distribution revealed above is repeated with specific motif forms (Figs 101, 102; Table 86). Again, no distinct geographical groups are evident, although the juxtaposition of the Agate Creek, White Mountains and Chillagoe samples may indicate a tendency towards such clustering. It cannot be said that clustering is strong, however, and this is perhaps most evident in the great dissimilarity of the Mungana sample, on the one hand, and the Rookwood and Chillagoe ones on the other. This pattern is evident on both the MDS map and on the dendrogram.

Discussion of the Peckings. The MDS and Cluster Analyses support the field observation that pecked motifs in north Queensland are relatively homogeneous across space as far as form is concerned. Nevertheless, there are hints that some regional differences may exist, although these are by no means strong. For example, the neighbouring Laura and Koolburra sites contain a number of curvilinear and rectilinear mazes, whereas only a single example has been recorded

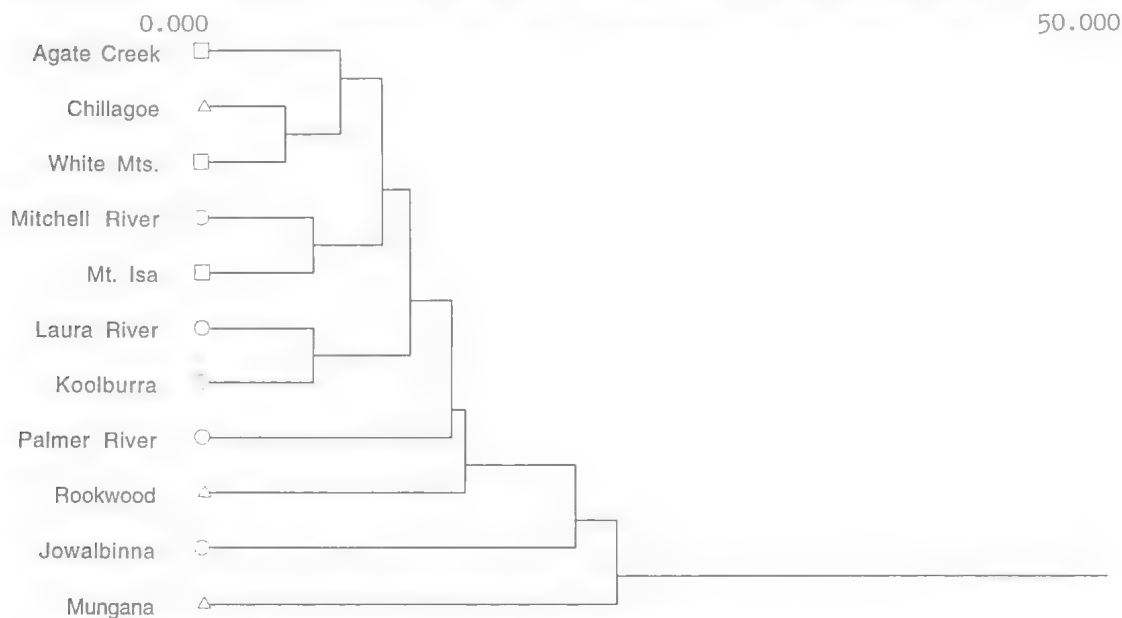


FIG. 100. Average linkage dendrogram for general motif forms (peckings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

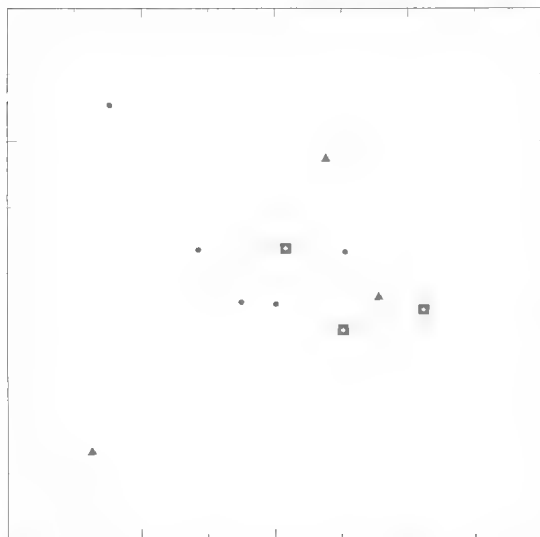


FIG. 101. MDS map for specific motif forms (peckings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

to the south (at Chillagoe). It is possible that their rarity in the Rookwood-Mungana-Chillagoe limestone belt is due to small sample sizes, but this is unlikely to be the case for areas further to the southwest, given that relatively large numbers

of engravings have been recorded there. Therefore, although the degree of rock art regionalism is small, there appears to be a gradual change from the northern parts of southeast Cape York Peninsula to Mt Isa in the southwest. This change involves specific motif forms rather than changes in overall assemblages, and is especially noted by the exclusion or near exclusion of mazes in the southwest, in contrast to their relative commonness to the northeast.

THE RECENT (PAINTED) ART

General Motif Forms: Figurative, Track and Non-Figurative Designs. For paintings, the most obvious geographical pattern noted was a marked difference between a northern group of subregions, consisting predominantly of figurative paintings, and a southern group of non-figurative and track designs. This north-south division was relatively distinct, with a boundary zone located somewhere between the Mitchell River and Rookwood Station (20km apart).

This dual pattern is also revealed in the multivariate analyses (Table 87; Figs 103, 104). The two clusters of subregions are discrete, showing no evidence of clinal variation. The two groups are:

Northern Group — Clack Island, Cliff Island, Flinders Island, Bathurst Range, Jane Table Hill,

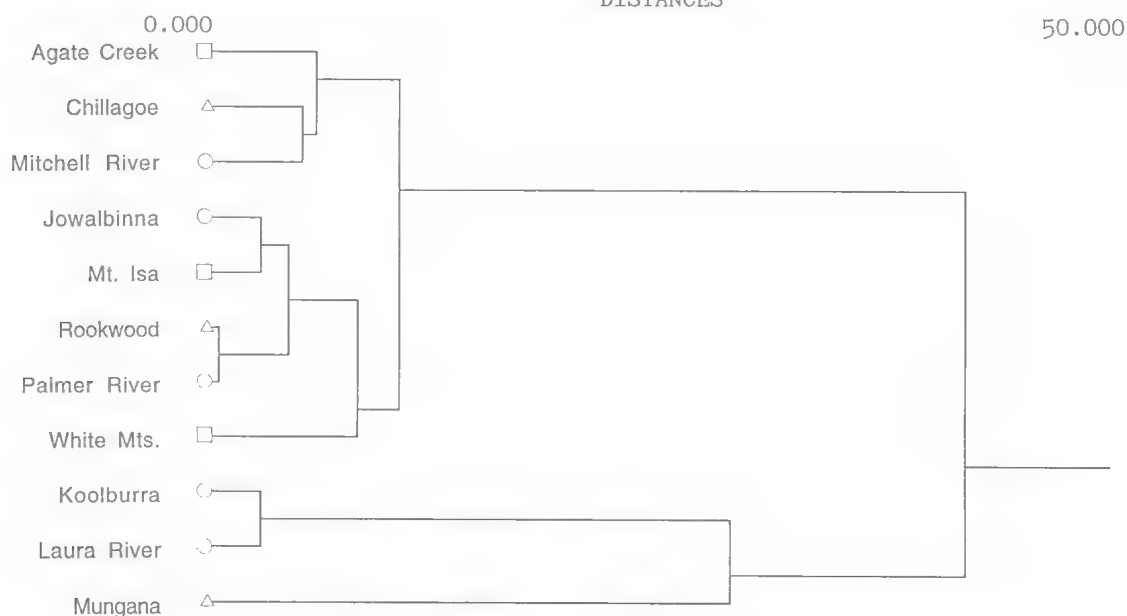


FIG. 102. Average linkage dendrogram for specific motif forms (peckings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

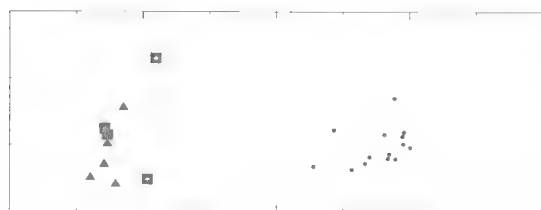


FIG. 103. MDS map for general motif forms (paintings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

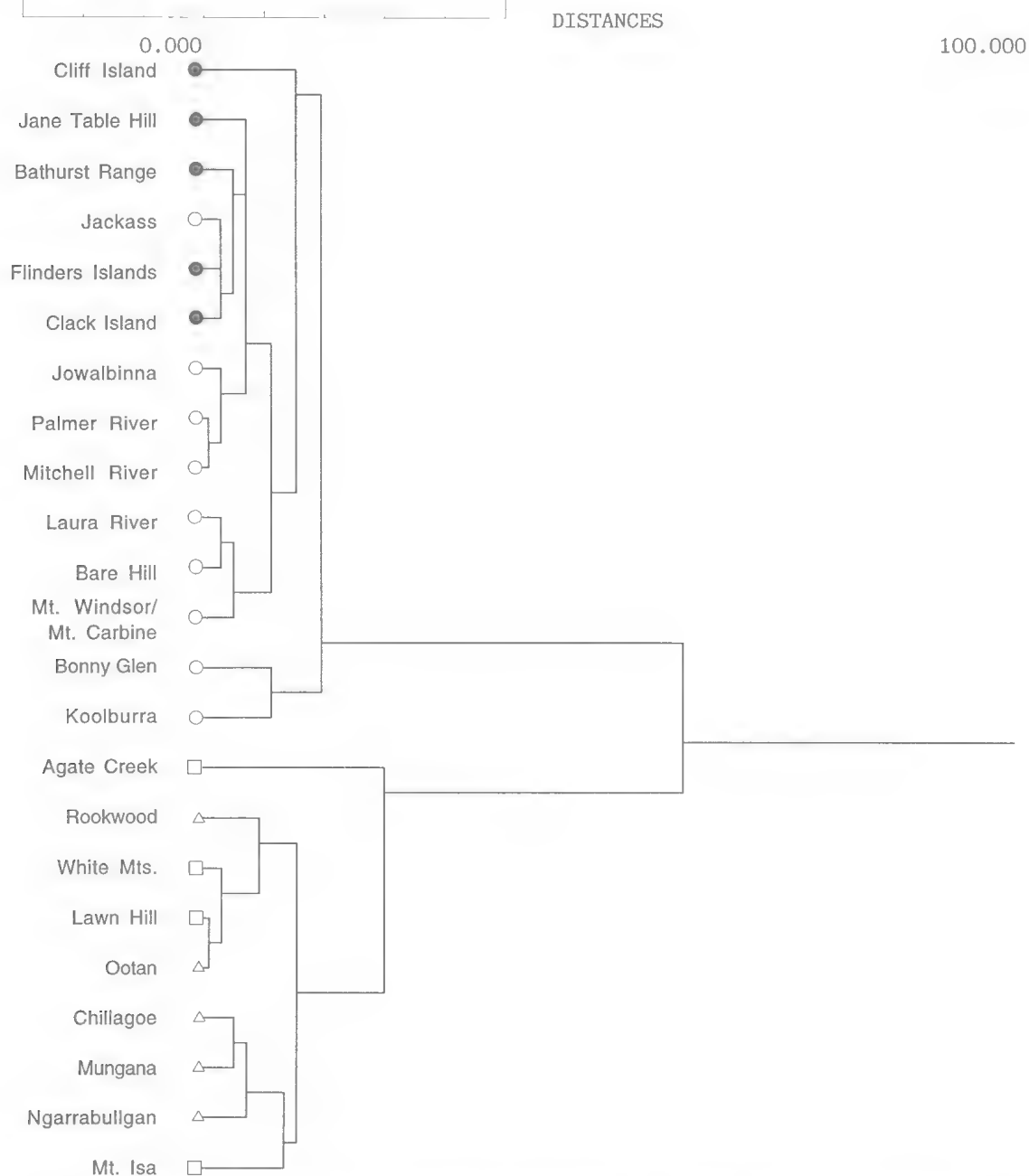


FIG. 104. Average linkage dendrogram for general motif forms (paintings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York. The infilled circles are the subregions comprising Princess Charlotte Bay and the Flinders Island group.

Koolburra Plateau, Jackass Station, Jowalbinna Station, Laura River, Palmer River, Mitchell River, Bonny Glen Station, Mt. Windsor and Mt. Carbine, Bare Hill

Southern Group — Ngarrabullgan, Rookwood Station, Mungana, Chillagoe, Ootan, White Mountains, Agate Creek, Lawn Hill, Mt. Isa

In the Cluster Analysis, a secondary cluster is also evident in the northern group, where the five sections of Princess Charlotte Bay and the Flinders Island group cluster together along with some of the Laura areas and the Mitchell-Palmer limestone belt.

Specific Motif Forms. The pattern that emerges when specific motif forms are compared is similar to that of the previous statistic (Table 88; Figs 105, 106). In the present case the Princess Charlotte Bay and Flinders Island group are distinguished as a third regional group. This is largely due to the predominance of two important motif forms — moths/butterflies and zoomorphs with crescent heads — in these sub-regions, and their total absence from all other areas.

Linear Figures, Infills and Internal Decorations. The conventions of linearity, infilling and internal decorations are independent of motif forms. Yet, again, the same geographical pattern as was observed in the formal analyses re-emerges (Table 89; Figs 107, 108). No data were

available for Princess Charlotte Bay and the Flinders Island group. Two distinct and discrete regional sets are identified, representing the same northern and southern groups identified previously. In the southern area, paintings are predominantly linear, with little evidence of internal decorations. To the north, infilling predominates. While outlined and infilled paintings are present in both geographical sets, they are more common in the north.

Monochrome, Bichrome and Polychrome. A breakdown of pictures into proportions of monochrome, bichrome and polychrome paintings reveals a pattern consistent with the previous results, although here it is not as clear (Table 90; Figs 109, 110). The dendrogram is more nested and, although all members of the southern group are joined in one major group, a number of northern areas also occur there. The looseness of the cluster here indicates that the north/south division previously noted is not as distinct with respect to the numbers of colours used as it was with respect to motif forms. There is, nevertheless, a tendency towards monochrome paintings in the southern sites, and towards bichrome paintings in most of the northern areas. This tendency also emerges in the MDS map, where the southern subregions are clustered together towards the left of the image, while the northern areas are scattered throughout the map. This indicates that the northern set is more varied, whereas the southern is less so, being consistently represented by high proportions of monochrome paintings.

Colours Used. The final variables analysed were the colours used in the paintings. Again, no data were available for Princess Charlotte Bay and the Flinders Island group.

The MDS map and Cluster Analyses identify three major clusters (Table 91; Figs 111, 112). The first of these includes the neighbouring subregions of Rookwood Station, Mungana, Chillagoe, Ngarrabullgan and the White Mountains. The second cluster contains the three Laura areas (Laura River, Jackass Station and Jowalbinna Station), and the third cluster contains the remaining subregions. The Mitchell and Palmer Rivers are closely linked at a low level in the dendrogram. These patterns are interpreted to reflect a major separation of most of the southern subregions from the northern ones, with the latter containing a number of secondary geographical clusters (e.g. the Mitchell-Palmer limestone belt). Again, this may suggest significant variation in the northern group.

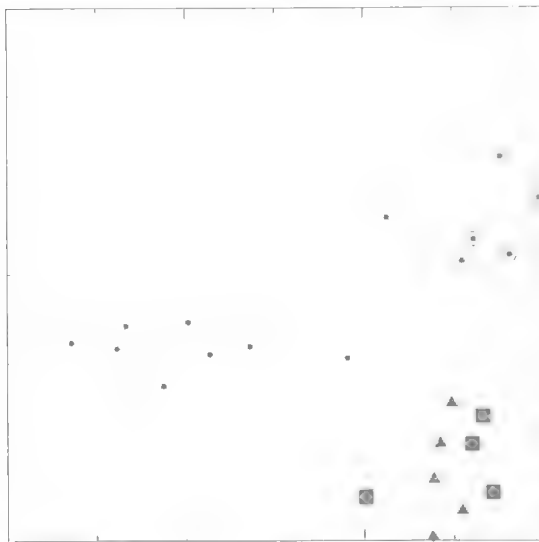


FIG. 105. MDS map for specific motif forms (paintings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York. The concentric circles are the subregions comprising Princess Charlotte Bay and the Flinders Island group.

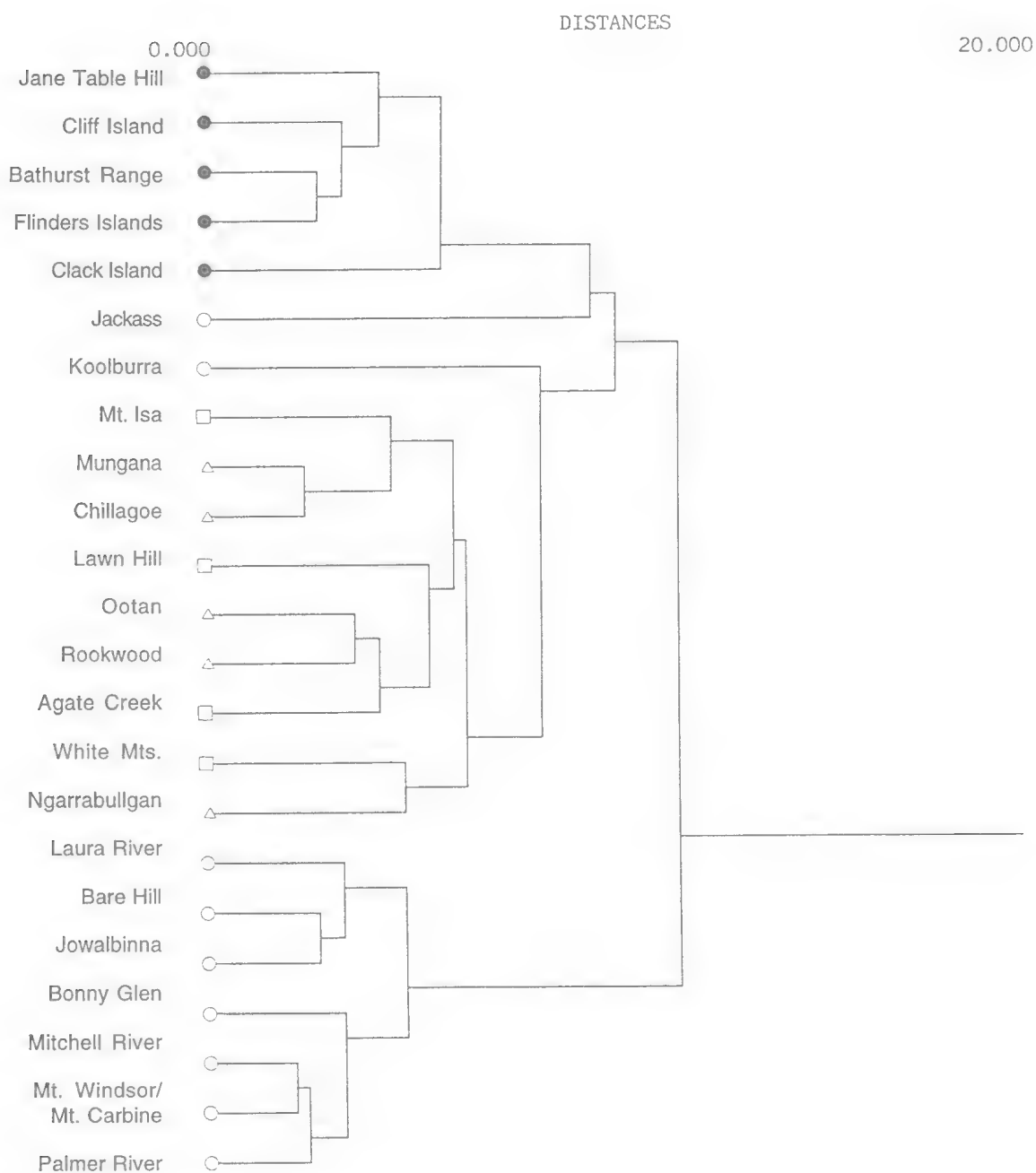


FIG. 106. Average linkage dendrogram for specific motif forms (paintings); triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York. The infilled circles are the subregions comprising Princess Charlotte Bay and the Flinders Island group.

The most obvious cluster indicates a distinct use of colours in the south. Table 91 shows that this geographical distinction is due largely to a greater emphasis of white paintings in the

southern areas. Black (charcoal) is also common throughout the Rookwood-Mungana-Chillagoe limestone belt, but less common to the north.



FIG. 107. MDS map for painting conventions of linear figures, infilling and internal decoration; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

As already noted above, these results may be interpreted in a number of ways. They need not indicate differences in socio-cultural conventions per se, given that the differential availability

of pigments (colours) may be affected by geological factors. Nevertheless, black (charcoal) is universally available. The large numbers of charcoal paintings in all parts of the Rookwood-Mungana-Chillagoe limestone belt, and their rarer appearance in most areas to the north, cannot simply be explained by the differential availability of raw materials. Similarly, the repeated importance of white pigments in all southern areas except for Agate Hill and Lawn Hill (which are located at a considerable geographical distance from southeast Cape York Peninsula), and their rarity to the north, is likely to reflect more than the local availability of pigment sources. The southern subregions contain a broad range of geological conditions, including limestone (Rookwood Station,

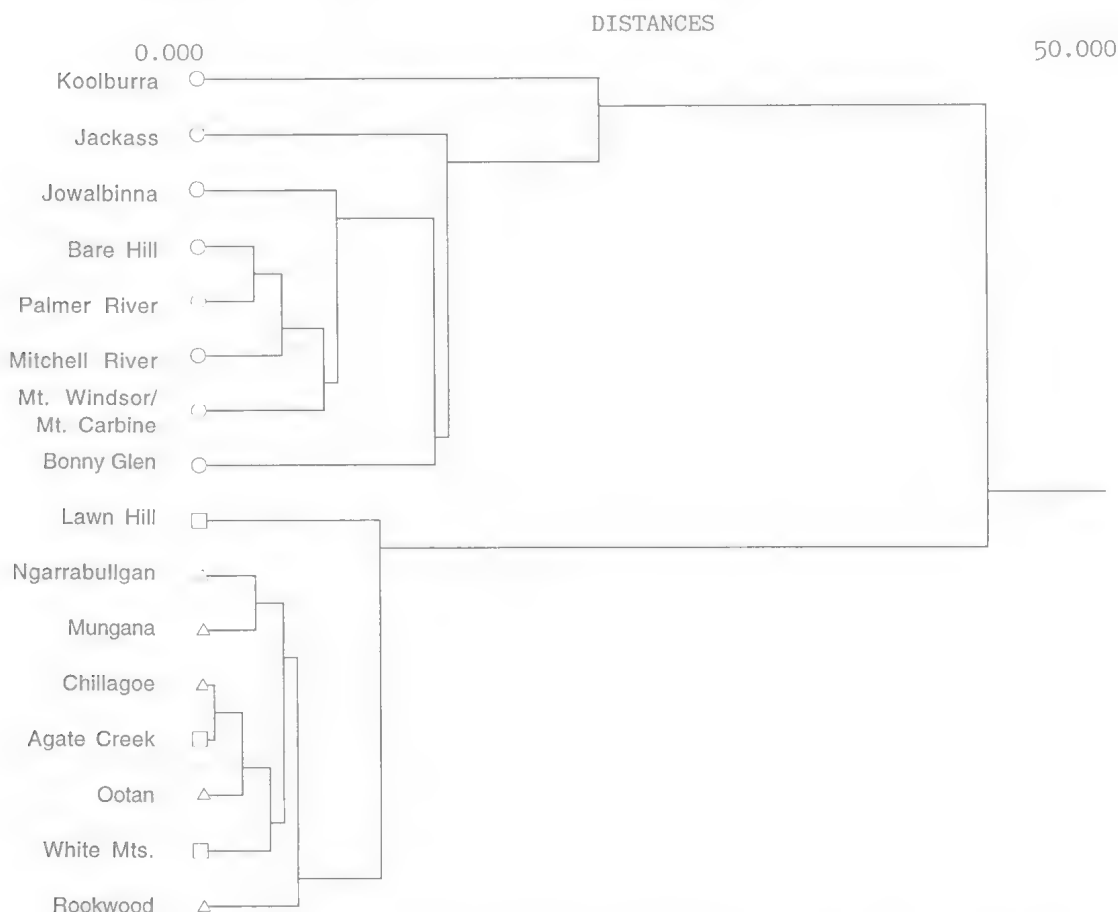


FIG. 108. Average linkage dendrogram for painting conventions of linear figures, infilling and internal decoration; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

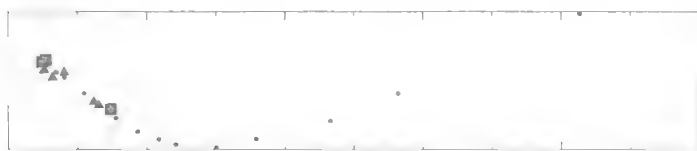


FIG. 109. MDS map for numbers of colours used; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

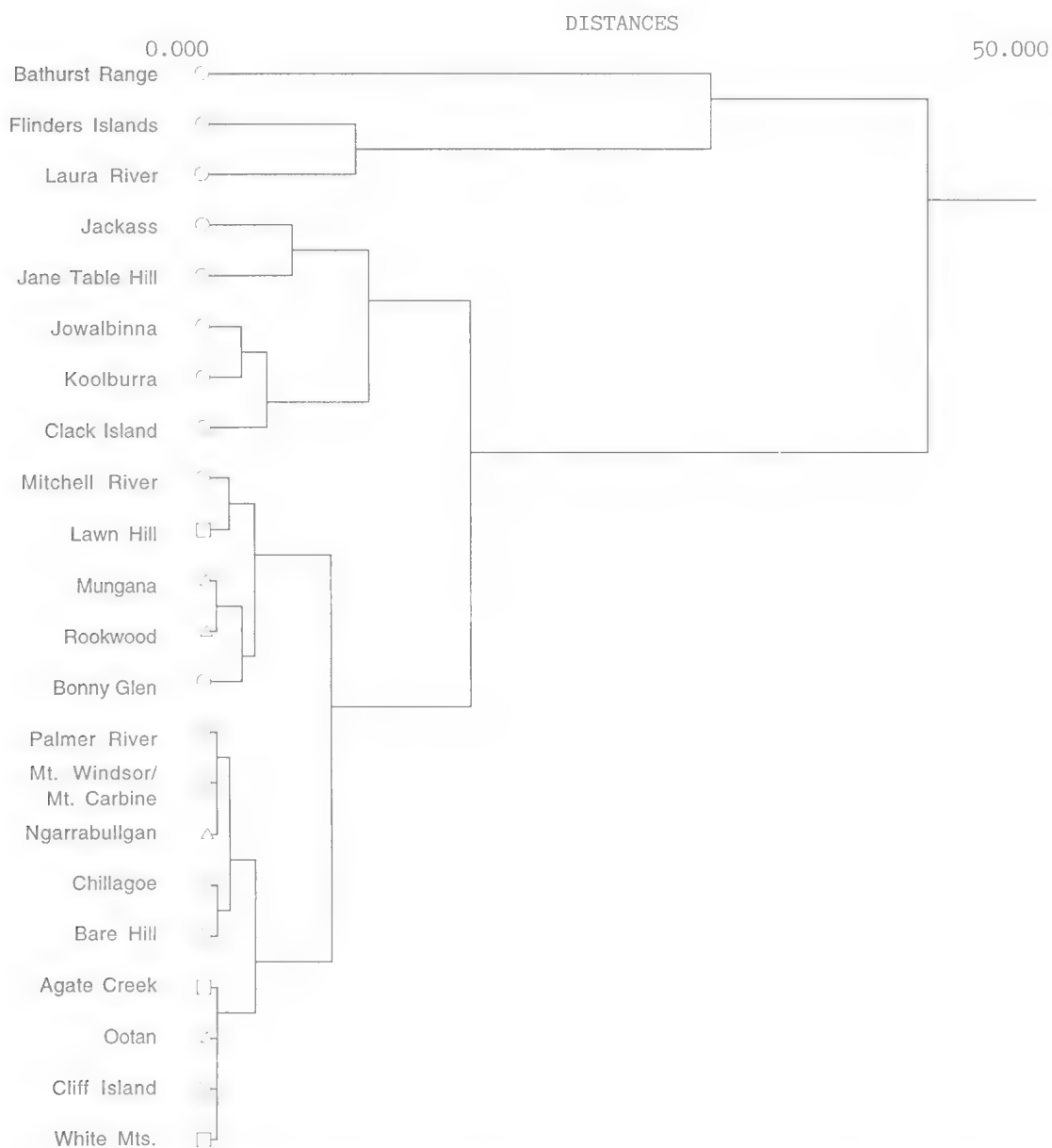


FIG. 110. Average linkage dendrogram for numbers of colours used; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.



FIG. 111. MDS map for colours used; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

Mungana, Chillagoe), granite (Ootan), volcanics (Ngarrabullgan) and sandstone (Ngarrabullgan). Consequently, white pigment art does not only occur within a single geological setting, but in a broad range of areas, where lithologies are varied. On the other hand, none of the northern subregions contain large numbers of white paintings, even though they are located in a similar range of geological settings (that is, sandstone, limestone and granite areas).

In order to further address the issue of provenance, one of us (BD) has undertaken PIXE/PIGME analyses of red, yellow and white pigments from Fern Cave, as well as from a series of north Queensland sources of raw material. The elemental fingerprints obtained from the archaeological samples were then compared with those from the different sources of raw materials

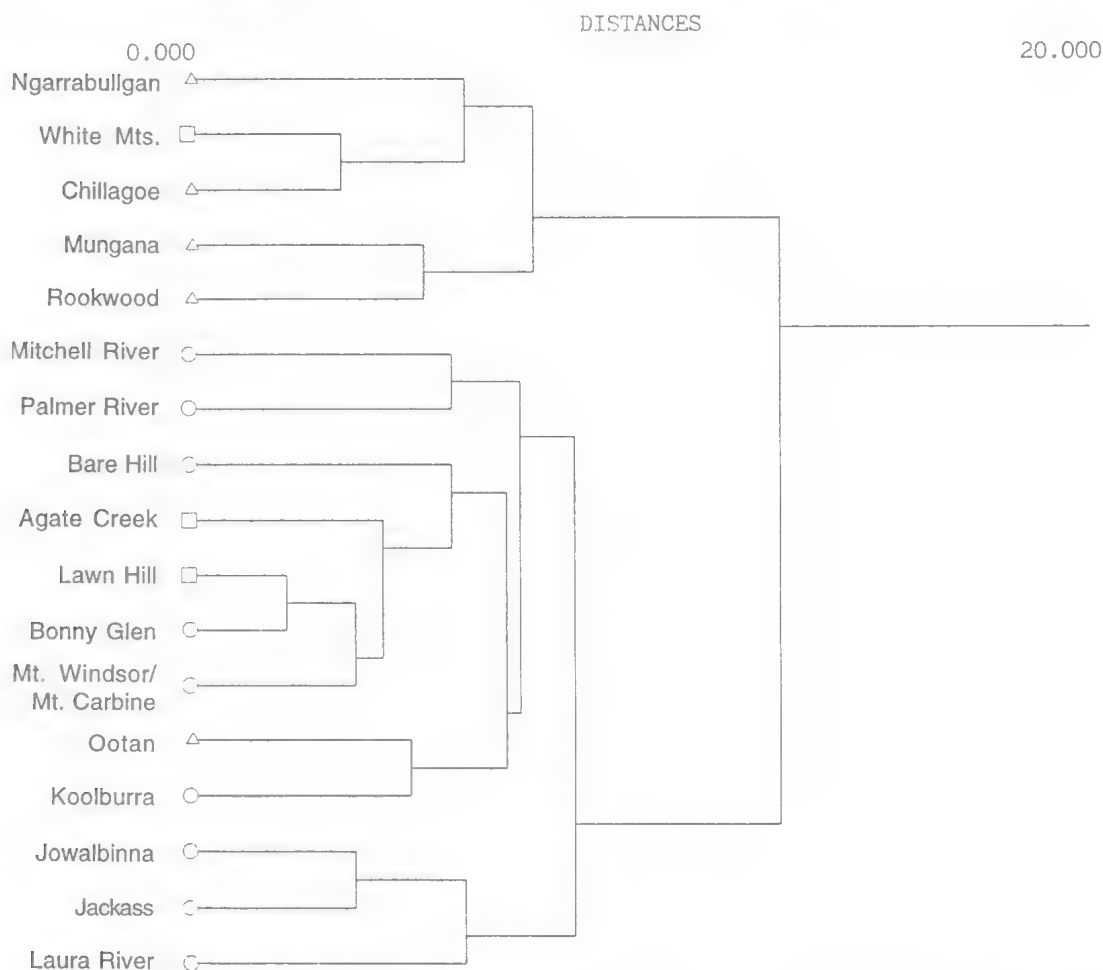


FIG. 112. Average linkage dendrogram for colours used; triangles are subregions located south of the Walsh River, circles are to the north, and squares are regions south and west of southeast Cape York.

to determine their provenance. Initial results of these tests (David et al., 1993), indicate that the majority of pigments used at Fern Cave seem to have been collected locally (that is, from the limestone belt). Similarly, Watchman et al. (1993) analysed the minerology of pigments from sites near Laura, and concluded that pigment sources were largely, if not entirely, local. The implications are that the colours used in the art do not reflect, to any significant extent, the use of foreign pigments made available, for example, through trade or exchange. Rather, they reflect decisions made largely on the basis of locally available colours. Given that the colours available in the north do not appear to be significantly different from those available to the south, it is concluded that the north-south division evident in the use of colours may indicate a discontinuity in socio-cultural phenomena. This north-south division is similar to that observed in the other variables analysed. The major difference in the colours used is a greater reliance on white pigments in the southern subregions than in the north.

STATISTICS AND THE FIELD OBSERVATIONS

If the peckings largely date to relatively early times, and the paintings to more recent times, then the rock art of north Queensland can be said to be patterned through space as well as through time. Although the temporal evidence is, at this stage, largely circumstantial, a general pattern is emerging, with the earlier art consisting mainly of non-figurative and track forms, and the more recent art being more regionalised in character.

Within this broad temporal framework, a number of spatial trends are evident. Firstly, an early (pre-mid Holocene) tradition of relatively homogeneous peckings of non-figurative and track forms are found throughout the study region. The main forms are characterised by geometric, linear and trident designs, although mazes may be more restricted in distribution (that is, they are rare in the Rookwood-Mungana-Chillagoe area and do not occur to the southwest of southeast Cape York Peninsula). Secondly, the paintings appear to be more recent than the majority of peckings, and probably largely date to the last 3,000-2,000 years or so. In some areas (e.g. Laura), peckings appear to have continued to be made after the beginnings of intensive painting activity, whereas elsewhere their crea-

tion ceased before the onset of the painting phase (e.g. Chillagoe).

Two major sets of painting conventions have been identified: a southern one spans the area between Ngarrabullgan and Mt Isa (possibly extending further to the southwest), and a northern one stretches from Princess Charlotte Bay to the Mitchell River to the south, and Bare Hill to the southeast (Fig. 113). The southern paintings were often painted in white, and were predominantly linear, non-figurative forms reminiscent of the earlier peckings. In contrast, the northern paintings contain a new range of forms, most of which are figurative, infilled designs. They were predominantly undertaken in monochrome, although bichrome is also common.

It may be said that the reason for the difference between an early homogeneous artistic tradition and a later, regionally differentiated one is due to a difference in scales of analysis; that is, the earlier peckings cover a long time-span, including possibly 30,000 years of prehistory, whereas the later paintings only cover a period of 3,000 or so years. As a result, we could expect the peckings to be more homogeneous across space as, through time, a greater range of conventions will have accumulated in any given sub-region. However, this explanation is not satisfactory. Although pecking conventions are distributed in a more homogeneous fashion across space, the range of motif forms is far more limited than that of paintings; that is, there is a smaller number of motif forms among the peckings.

The dual geographical division of paintings is strongest when it comes to motif forms. It also emerges, however, in the colours used and in the use of linear figures, infills and internal decorations. Nevertheless, this north-south division cannot simply be viewed as the only spatial trend. Within this division, there are also many regionally specific traits, and this factor may be critical for a fuller understanding of the division itself. Hence, the northern group can be further sub-divided into a number of sub-sets. To the north, for instance, the Princess Charlotte Bay and the Flinders Island group contain large numbers of moth/butterfly designs and zoomorphs with crescent heads. In each case also, marine motifs and, in some cases, paintings containing white-dotted outlines, are common. The Laura paintings (Jowalbinna Station, Jackass Station, Laura River) possess a very broad range of motif forms undertaken in a broad range of colours, including many

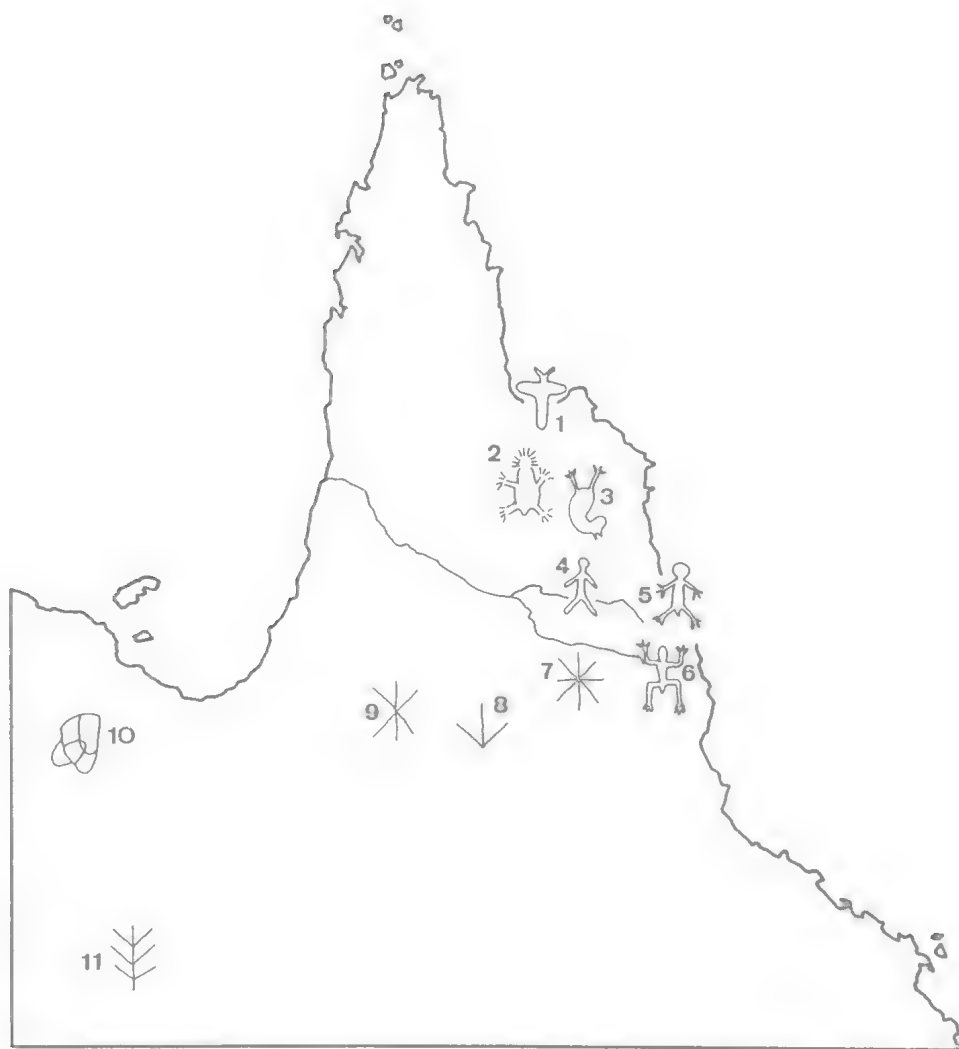


FIG. 113. Summary of geographical sets based on predominant painting forms. 1, Princess Charlotte Bay & the Flinders Is. Group; 2, Koolburra Plateau; 3, Laura (Jowalbinna, Jackass, Laura R.); 4, Mitchell-Palmer; 5, Bonny Glen & Mt Windsor/Mt Carbine; 6, Bare Hill; 7, Rookwood, Mungana, Chillagoe, Ngarrabullgan & Ootan; 8, Georgetown (from slides held at the Cultural Heritage Division, DEH); 9, Croydon (from slides held at the Cultural Heritage Division, DEH); 10, Lawn Hill; 11, Mt Isa.

large, often life-sized anthropomorphs and zoomorphs. Many of these are internally decorated. Endemic to the Koolburra Plateau are echidna beings—therianthropes characteristic of this area. The Mitchell River and Palmer River samples consist almost exclusively of monochrome infilled anthropomorphs, and the total absence of paintings of macropods in both areas is in marked contrast to their relatively common occurrence in the Laura area to the immediate north. A dominant theme among the Bare Hill paintings are relatively small

anthropomorphs with upraised arms and down-curved legs.

This tendency towards regional specificity in dominant motif forms also appears to the south. Thus, the Rookwood Station, Mungana, Chillagoe and Ootan paintings all possess large numbers of radiating designs, whereas further to the southwest they are much rarer. At Lawn Hill, sinuous lines are common, while at Mt Isa a broad range of forms (including monochrome anthropomorphs and a predominance of circle variants) are found. In short, here too, regional variation is apparent, al-

beit within a predominantly non-figurative painting tradition.

SUMMARY AND CONCLUSION

In summary, the multivariate tests suggest that the rock peckings of southeast Cape York Peninsula are not significantly regionalised in their distribution of forms, whereas the paintings are. At least two levels of geographical spacing can be identified in the paintings. Firstly, there is a broad north-south division of dominant motif

forms, colours used and conventions of linearity. And secondly, within each of the northern and southern areas, the paintings appear to be highly regionalised, especially with respect to form. Neither of these patterns were identified for the peckings. Given that most of the peckings appear to date to pre-mid Holocene times, and that the paintings are thought to largely date to the mid to late Holocene, it is hypothesised here that a change can be detected from an earlier, relatively homogeneous artistic tradition, to more recent, highly regionalised ones.

DISCUSSION

MODELLING CHANGE IN NORTH QUEENSLAND PREHISTORY

Throughout this work, emphasis has been given to data that are relevant to an investigation of change and stability in north Queensland prehistory. In some classes of information, such as deposition rates of cultural materials, the temporal trends obtained are relatively secure, in that for most sites, subregions and regions, systematic increases can be shown to have taken place during the mid to late Holocene. For other evidence, the temporal trends observed relied principally on circumstantial evidence, as was the case for the dating of north Queensland's rock art. Nevertheless, a consistent pattern has emerged, despite differences in the reliability of the chronological frameworks constructed for the separate sets of data (e.g. artefact deposition rates, beginnings of new site types, antiquity of cave paintings and so forth). The pattern indicates that significant changes in socio-cultural practices have taken place during the mid to late Holocene. It is now time to draw together these findings in order to investigate the dynamics of socio-cultural practices in north Queensland prehistory.

SOUTHEAST CAPE YORK PENINSULA: THE TRENDS

Considerable detail has been presented to investigate whether or not temporal patterns could be identified at sites excavated in southeast Cape York Peninsula. The observed trends were rather coarse grained, in that the exact chronological relationship of the various changes noted within

and between sites suffered from poor temporal resolution. Nevertheless, significant increases in rates of site establishment and deposition, as well as the first appearance of burin adzes, were evident during the mid to late Holocene in all areas studied. Of importance is that these changes were not necessarily synchronous in the various sites and subregions. Furthermore, at Princess Charlotte Bay there is also evidence to suggest the commencement of new subsistence-settlement systems (systematic mound construction) during this time, with a specialised focus on mangrove resources. In all areas, during the mid to late Holocene, there is also a significant increase in the number of cave paintings undertaken, with prior, earlier art consisting predominantly of peckings. Generally similar changes have also been documented throughout eastern Australia. These include the beginnings of technologies involving the specialised or intensified use of seeds, the systematic leaching of toxic plants, a broad range of new stone artefact forms and technologies, new site forms (e.g. earth mounds) and possibly large-scale water management and fishing installations in some areas. In some cases, these innovations or embellishments may have enabled productive yields to increase, or to have been more effectively managed. Examples of this are what appear to be the increased numbers of complex fishing installations in various parts of the Queensland coast, NSW and Victoria, and use of grass seeds in arid and semi-arid areas.

The modelling of change in the prehistory of southeast Cape York Peninsula must account for these fundamental characteristics of the archaeological record. While it is recognised that the complexity of the observed diachronic trends has been obscured by the coarse grained nature of some archaeological methods, it should also be

appreciated that we are investigating the behaviour of human actors set within complex social and ecological fields. Because any given context of human behaviour will only involve a small part of the total behavioural range of a group of people, we should expect new strategies to display a broad range of archaeological expressions. Given the relatively coarse grained temporalities of the archaeological record, contemporaneous social changes, therefore, need not be synchronous archaeologically. Therefore, it is not possible to say exactly how the timing of changes (in the various sites) relates to that of social change.

Nevertheless, we argue that spatial behaviour is linked to territorial (that is, land owning and land using) networks. Spatially patterned behaviour relates to the activities of people on the ground, and thus it is assumed that spatially patterned traces of human activity are related to contexts of social praxis. For instance, the movement of people from one place to another (for example, from one country to another) implies that there is an openness that allows that movement to occur, whether that openness is a result of structured norm (e.g. via belonging to a place or via the use of visas) or not (e.g. illegal immigrants). In either case, the degree of openness is contextual, in the sense that degrees of closure can emerge if the context changes.

An example of the relationship between spatial behaviour, rock art and territoriality can be seen from Wardaman country, Northern Territory. We use this example not as evidence that the situation was the same in north Queensland in the past, but as an example of the way such a relationship can be operationalised. In this sense, we would argue that rock art, by virtue of its representation in spatial behaviour, articulates aspects of territorial space.

Wardaman country is located to the southwest of Katherine, Northern Territory. Wardaman people generally recognise matri-totems (the *ngurlu*), assign subsection partly, though not exclusively, through the mother, and practice a matri-focal system of parent-child relationship. There exists a matrilineal complementary relationship to land, with patrilineal being primary (F. Merlan, Sydney University, pers. comm., 1991).

During the recent past, Wardaman country was divided into various estates, each of which reckoned a cosmological identity with specific Dreaming beings. Some of these were travelling beings (such as *Gorondolnni*, the Rainbow Serpent), while others concerned specific parts of the landscape only (e.g. *Gandawaq*, the moon, at Jalijbang). While the entire landscape thereby

gained its identity and was made discontinuous by its affiliations with specific Dreaming beings and events, it was united into a cosmological whole by its common participation in a unified system of land and law expressed in the Dreaming. In this sense, the land is a humanised landscape (Rigsby, 1981), and the way in which the various estates are broken up and interlinked at various levels reflects the pattern of Wardaman land tenure and land use.

The land's Dreaming identities are central to the local belief system. It is in the Dreaming that Wardaman ontology is centred. Dreaming realities are expressed everywhere — in the mountains, rivers, trees and rock outcrops. As Merlan noted: *'The Wardaman use the word laglan "country, place, site" (and also camp) to refer to tracts of country and places within them to which they claim attachment, as in the phrase nganinggin laglan "my country". Each such country is composed of many different sites, at least some principal ones of which are associated with estate-linked buwarraja, that is, creator figures or "dreamings" which are saliently or exclusively identified with that particular country. An example is the association of girribug "pheasant coucal" with a particular country ... of which the Willeroo homestead and some neighbouring places are focal sites. In addition to these particular estate-linked and bounded dreamings, through each country there pass at least some mythological paths of other, long-range dreamings, many of which ... happen to come from the west and northwest, as far away as Port Keats and Western Australia. Thus each country, or "estate" (see Maddock 1982) is defined by a particular constellation of far-travelled and more local dreamings and sites.'* (1989b: 4-9).

In short, the landscape consists of a complex patchwork of landed Dreamings crisscrossed by non-local, travelling ones, both of which give identity to the land and link Wardaman country with neighbouring lands. Individual places identified as of specific significance to Wardaman people take many forms, from features such as waterholes or hills, to smaller objects such as rocks or prominent trees, including individual or complexes of rockshelters. It is in the latter that rock art is most commonly found.

Much of the art located in Wardaman country is *buwarraja* and was never created by people, but are (rather than represent) the Dreaming beings themselves which sit in the rock (cf. Merlan, 1989a; Frost et al., 1992). Such sites are imbued with the essence of Dreaming beings,

whose identities often reflect the identities of the land in which the site (and hence paintings) occurs. In this way, the rockshelters at Nimji and Murning, near the Yingalarri waterhole, have important associations with *gulirrida* (peewees), and as such many painted figures at these sites are *gulirrida* to local Wardaman people.

But there is an even more important way in which the rock art expresses land affiliations, and thus contexts of openness and closedness, in Wardaman country. Artistic conventions are widespread across areas where interaction is relatively unrestricted, such as throughout Wardaman country and in regions to the southwest, where important social and cultural links exist. To the north, however, major discontinuities in social interaction existed during recent times, and this is also where major changes begin to appear in the rock art. For example, X-ray paintings were common during the late Holocene in Arnhem Land (to the immediate north of Wardaman country), but these are extremely rare in Wardaman country (Taçon, 1993). As Taçon (1993) noted, regionalism in social behaviour tends to be expressed in the material attachments of social practice, including rock art. However, any single aspect of the material record will rarely, if ever, be capable of expressing the full range of spatial (social) behaviour. This is because of the large number of social contexts operating.

A number of major archaeological changes have been documented from southeast Cape York Peninsula. These changes include alterations to the spatial patterning of the rock art, and we would therefore argue that a major re-organisation of territorial networks may be involved. The presumed mid to late Holocene rock art of north Queensland is divided into two relatively distinct and discrete geographical sets, a northern, predominantly figurative tradition of paintings, and a southern, non-figurative. Within each of these two zones, rock art styles are highly regionalised. There is an important aspect of this regionalisation, however, that has not yet been addressed (as it lies largely outside the scope of this work). It concerns the distribution of faunal categories in the art, and its relationship with the hunted fauna. It has already been noted that a significant proportion of the excavated faunal remains from the Mitchell-Palmer subregion consist of food debris dominated by macropods — *Petrogale* sp., *Macropus* spp. — and other marsupials (e.g. *Trichosurus vulpecula*). The total absence of macropods from the paintings of this subregion, and the general lack of agreement

between the range and relative representation of fauna recovered from the excavations and those represented in the paintings, may thus be significant. The implications are that the animals painted on the cave walls were not just a reflection of dietary breadth, nor an indication of the past symbolic importance of the hunted and foraged fauna. On the contrary, the two sources of faunal representation — the painted animals and the animals represented in the food debris — represent two distinct information domains, each of which relates to a different set of socio-cultural principals. In other words, data obtained from the excavated food remains relate to subsistence behaviour and its associated symbolism, whereas the painted forms are an archaeological window into a totally different aspect of prehistoric life within a site and region. By investigating the latter we are investigating a system of visual forms structured by socio-cultural convention, a system of symbols whose investigation can reveal something about the nature of symbolic vocabularies but not about their related original meanings (cf. Frost et al., 1992). Concerned here is the structuring of socio-cultural imagery, the ordering of symbols as formal representations, and the portrayal of rock art forms in specific proportions. Hence, why are there no recorded macropods in the Mitchell-Palmer rock paintings, especially given their importance in the rock art of Laura to the immediate north? The implication is that *spatial discontinuities may have existed in the distribution of socio-cultural conventions relating to symbolic behaviour as well as rock art*. We would thus argue that it is by generating systematic research on past socio-cultural systems in southeast Cape York Peninsula — that is, on the relationship between resource structures, symbolic representations, technological conventions etc., and their continuities and discontinuities across space and through time — that significant new inroads may be made into this issue. This is a particularly intriguing aspect of north Queensland's rock art that, unfortunately, cannot be adequately addressed here, but which may prove a fruitful avenue for future research.

That the timing of intra-zonal regionalisation appears to correspond with the genesis of the north-south separation implies that the two patterns may be part of one general historical process. It is important to note here that we refer to the art's antiquity as presumed because the evidence so far is largely circumstantial, and therefore interpretation is still to a large degree hypothetical.

MODELLING CHANGE IN NORTH QUEENSLAND PREHISTORY

An understanding of present socio-cultural practices is important for the study of the past. This is based upon the conviction that current socio-cultural systems, including the ontological structures upon which they are based, are the products of particular historical conditions whose trajectories are traceable archaeologically. That is, contemporary societies and cultural forms are the endproducts of everchanging historical conditions which have (and continue to) change through time as a result of specific choices made by people. This, in essence, is what we know as the historical process (David, 1991f; Hodder, 1986b; Sartre, 1968; Shanks & Tilley, 1987). In this sense, human history is the result of the process of decision-making, and of decisions made. The material manifestations of some of these cultural choices can be traced back through the archaeological record.

The tack that we now follow is somewhat different. We explore the ethnographic literature in the hope of identifying social processes that may have given rise to the regionalised landscape observed archaeologically. In doing so, we take as our starting point the assumption that societies are composed of networks of interrelated systems and subsystems, and that to understand such systems, we have to enquire as to how they emerged from prior historical circumstances. Our aims here are not to impose particular social formations (as observed ethnographically) onto particular archaeological signatures (contra Rosenfeld, 1992). Rather, we are specifically exploring ways in which regionalised social landscapes might emerge (see Bender [1992], David [1991d] and Gosden [1989] for discussions of social landscapes). Ideally, to do this would require an extensive survey of the anthropological and sociological literature. Constraints on time and space do not permit us to do this. We have therefore restricted ourselves to ethnographic observations from the study region.

TOWARDS A PREHISTORY OF INTER-REGIONAL RELATIONS: EXPLORING THE NORTH-SOUTH DIVISION IN THE LATER ROCK ART

During his ethnographic enquiries in western and southwestern Queensland, Roth (1897: 136) noted that '*... it happens that ideas are interchanged, superstitions and traditions handed on*

from district to district, and more or less modified and altered in transit, that new words and terms are picked up, and that corroborees are learnt and exchanged, just like any other commodities'.

Stylistic conventions operate in relation to existing and interacting socio-cultural structures.

Although very little is known of the lifeways of Aboriginal peoples from the areas from which the rock paintings were recorded, it is interesting to note that interviews conducted by one of us (BD), in 1984 with a number of early European settlers in Chillagoe, indicated that Chillagoe Aborigines (south of the Walsh River) had very little contact with people to the north. Although these interviews were not directed at the types of questions posed in this work, Paddy Byrnes and Sugar-bag George, two early European residents at Chillagoe, both independently noted that the Palmer (northern) Aborigines were '*hostile to Chillagoe Aborigines*' (P. Byrne, pers. comm., 1984; cf. David, 1987).

Similarly, others have also reported differences in the ways Aboriginal people at Ngarrabullgan interacted with people from the south and the north. Hence Richards (1926: 249), a long-time resident in the area, noted that the Aboriginal people of Ngarrabullgan recognised an essential affinity and shared an '*almost identical language and customs*' with the peoples of Rookwood, Mungana, Chillagoe, Ootan and other areas to the south (Richards's Wakoora, Chunkunberry and Wun-yurika), but not with peoples to the north, such as Richards's Kooka-minnies. He noted: '*These tribes were warlike and were often fighting among themselves and with neighbouring tribes. About 1893 a tribe of Mitchell River natives known as the Kooka-minnies raided the Hodgkinson Valley. The combined Wakoora, Chunkunberry, and Wun-yurika tribes were outnumbered and stood no chance against the invaders. The Kooka-minnies took all the young women and the men were driven away.*' (Richards, 1926: 255)

This geographical division of alliances matches the north-south division noted in the rock art (Ngarrabullgan is at the northern extremity of the southern zone). Seventy-five years after the events reported by Richards, Edwards (1967) noted that the anthropomorphic paintings at Ngarrabullgan appeared to be very recent, and that they did not resemble the typical rock art of the area (resembling rather the paintings of the Mitchell-Palmer region to the immediate north). He thus concluded that '*I do not think that they can be regarded as belonging to the area, and*

there are no traces of human figures in the older paintings' (Edwards 1967: 7). The conclusions reached here support these views. Taken in conjunction with the information supplied by Richards, this may suggest that possibly longstanding enmity between people to the north and south of the Mitchell River has resulted in a recent influx of northern peoples into the Ngarabullgan area. If this is so, the incursion mentioned by Richards is likely to have been facilitated by post-contact events, such as population decreases following introduced diseases and massacres, coupled with a breakdown of traditional boundary zones through the installation of gold mines and cattle properties that employed non-local Aboriginal stockmen. Each of these factors helped to break down traditional Aboriginal territorial networks (see Reynolds, 1982; Richards, 1926: 249; Rowley, 1986). No anthropological work has yet been undertaken to shed further light on these issues.

SOUTH OF THE WALSH RIVER

A number of authors have noted that, during ethnohistorical times, social interaction to the south of the Walsh River often involved extensive trading networks, resulting in the continued exchange of goods and ideas over enormous areas in western Queensland, and, to a much lesser degree, in the east. Such exchanges often involved large numbers of people sharing innovative ideas (such as dances and songs, of which the Molonga ceremony is a good example [cf. Mulvaney, 1976]), thus acting against the development of distinct and geographically isolated stylistic conventions. It is argued here that such a network of exchange behaviour may be responsible for the close similarities of rock art styles in those regions south and west of the Walsh River, including Ngarrabullgan, the Rookwood-Mungana-Chillagoe limestone belt, Ootana, the White Mountains, Agate Creek, Lawn Hill and Mt Isa.

In his detailed study of western Queensland Aboriginal lifeways, Roth (1897) repeatedly stressed the central function which extensive trading networks play in the life of western and southwestern Queensland Aborigines. His records include over 100 separate references to the trading of goods between regions sometimes over 200km apart. Here, where traditional territories are located immediately south of the Gulf of Carpentaria and stretch south to the Lake Eyre region, pituri, the arid zone native narcotic, formed a central cog in the trading machinery. Pituri, goverment blankets, human-hair belts,

bilbi-tails and other commodities were, for example, traded for shields, stone knives, possum twine, human-hair twine and spears by peoples of the Boulia district. Trading routes almost always followed natural watercourses, with pituri generally moving from the more arid western regions to the east, where it did not grow naturally (Roth, 1897: 132-138).

Such exchange networks enabled extensive inter-group contacts through meetings between members of separate social and linguistic affiliations and set up the means by which exogamous marriage bestowals could operate. This resulted in the creation of an extensive network of kin related individuals, a network often articulated by the coming together of large numbers of people through ceremonial gatherings. It is through such networks that ideas and conventions were continually passed on, that cultural norms became standardised and maintained, and that deviant behaviour became either recognised as such or transformed and institutionalised into accepted socio-cultural frameworks. Examples of shared cultural traits, beyond trade items and exchange goods, included variations of the four-class kinship system, with the eight-class system occurring to the immediate west of the region in question (Howitt, 1904: 30; Peterson, 1976).

The huge distances covered by individuals who travelled to partake in such exchange/ceremonial networks are central to the present discussion. Thus, for example, Howitt (1904: 710-11) and Smyth (1878, II: 304; in Mulvaney, 1976: 79) report people travelling 320-480km in the Coopers Creek region of the arid zone partly in order to participate in the trade of pituri and ochre. Similarly, individuals are known to have travelled over 400km to partake in ceremonies and/or trading networks in the Carpentaria-Lake Eyre region (Petrie, 1904: 250), while ochre has been known to have been traded over distances of 480km in the Flinders Ranges (Bruce, 1902: 83; in Mulvaney, 1976: 79). Elsewhere, Stanner (1989) reported seeing a Wardaman man visiting the Port Keats region, 250km from Wardaman country, early this century, whilst Myers (1986: 27) similarly reported that Maantja, a Pintupi man, met with people from the Pollock Hills, 100 miles (160km) to the west of his home country. The same man is also noted to have travelled 280km in one series of journeys associated with a single ceremonial gathering. Numerous other long distance treks have been reported from all parts of arid and semi-arid Australia, and although the longer distances were normally as-

sociated with formalised exchange and/or ceremonial gatherings, as Meggitt (1962: 52) stated for the Warlpiri, '*... small parties sometimes walked long distances simply to see kinsfolk and keep up friendships*'.

Maintaining relatedness was (and still is) the essence of many inter-group gatherings. Myers (e.g. 1986: 164) has repeatedly argued that, amongst the Pintupi, considerable energy was invested in maintaining contact between people, '*suppressing distinctiveness*' (Myers, 1986: 166) and reducing differentiation in the process of increasing one's network of social ties. Others, such as Meggitt (1962), have reported similar social processes among other arid and semi-arid Aboriginal peoples, while Roth (e.g. 1897) documented such behavioural characteristics for the peoples of western Queensland, including those of Mt Isa, Lawn Hill and other areas to the immediate east.

We have plotted all references to trade noted and published by Roth (1897-1910e) in his ethnographies in Fig. 114. His emphasis on western Queensland reveals extensive interpersonal relations south of the Gulf of Carpentaria, while he hints at further interactions northwards through an extension of the western Queensland trading routes (linking with southwestern Cape York Peninsula). If the distances travelled by individuals mentioned above are any indication, then it would take only four individuals travelling 480km each to cover the entire 1,830km distance between the Gulf of Carpentaria and the south Australian coast (that is, to traverse the Australian continent north to south). Even a smaller distance covered by each individual, say 280km, would require only seven individuals to cover the distance. And if Gason's (quoted in Curr, 1886, II: 70-71; in Mulvaney, 1976: 90) observations are correct that, in the Flinders Ranges, people travelled 30km a day for distances of over 320km in any direction, it would then take only 61 days to cross the area between the Gulf and the south Australian coast. The point to be made here is that particular socio-cultural conventions can be expected to have been widespread in western Queensland at least during the later stages of prehistory, given the open nature of interaction networks documented for ethnohistoric times (see also Yengoyan, 1976). Accordingly, it comes as no surprise to discover that the recent rock art found to the southwest of the Walsh River shares many common conventions over fairly broad areas, such as the widespread pre-

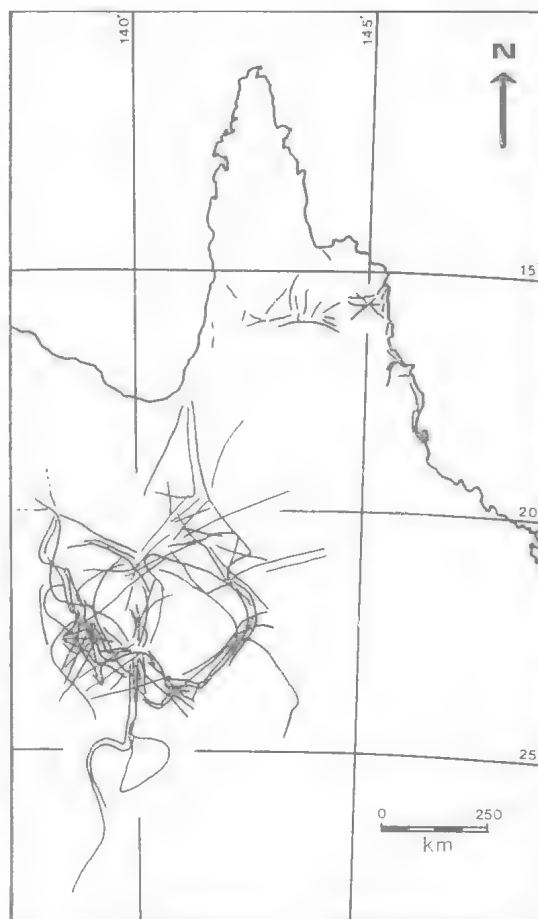


FIG. 114. All cases concerning trade in northern and western Queensland, as documented by Roth (1897-1910e).

dominance of non-figurative designs (e.g. circles, extended linear designs).

NORTH OF THE WALSH RIVER

During the early years of the 20th century, Roth reported intensive but short distance interactions between people to the north of the Walsh River. These interactions were operationalised in part through trade, offering a means by which ideas and material items could be exchanged between the various peoples of these regions. By these methods, this region was unified, to some extent.

The cave paintings of the Mitchell-Palmer limestone belt, Koolburra Plateau, Jowalbinna, Jackass Station, Laura River, Bonny Glen Station, Mt Windsor and Mt. Carbine, Princess Charlotte Bay and the Flinders Island group, and Bare

Hill all contain a predominance of monochrome infilled and bichrome outlined/infilled anthropomorphs and zoomorphs. Each of these subregions is located to the north or east of the southern group of subregions and, as such, they constitute a discrete geographical set. We would argue that these two issues — intensive social interaction to the north of the Walsh River and shared rock painting conventions — are linked.

Little is known of the prehistoric socio-cultural relations of the peoples from these subregions. Roth, who mainly visited areas to the west and east of the region, included the Mitchell-Palmer on his cultural map of north Queensland (1899b), but commented that there were '*no blacks here permanently*' (Roth, 1899b, plate 30). However, this is unlikely to have been the case, at least for any significant duration of time during prehistory, given statements made in early explorers's journals, the enormous wealth of prehistoric sites from the region, as well as its location near two permanent rivers. For example, both Leichhardt (1847) and Hann (1873) commented on the large numbers of Aborigines near the limestone karst outcrops of the Mitchell River. However, by the time Roth arrived, some 60 years after Leichhardt and 30 years after Hann, the north Queensland gold rushes had taken their toll on local Aboriginal populations.

Although the Mitchell-Palmer region was not central to Roth's studies (and it is possible that he never actually entered the subregion as no mention of it is made in his ethnographic texts, and it is located on the periphery of his map of north Queensland), other parts of the north are better documented by him. For instance, in addition to noting certain similarities in the tools and weapons of different north Queensland peoples, he also documented in some detail the nature of trade items and their destinies. Unless otherwise indicated, the following is taken from Roth's ethnographies (Roth, 1899a-1910e).

The principal times for trade throughout the region were during periods when food resources were plentiful, as was the case in other parts of eastern Australia. At Princess Charlotte Bay, reed spears, iron scraps and European axes were given by the Kuku Rarrmul of the Morehead River (Princess Charlotte Bay and Flinders group) to the Gugu Warra of the Normanby and Deighton Rivers (Jowalbinna and Laura areas) during early contact times. In return, the Kuku Rarrmul were given melo shells, grass-reed spears, nautilus shell necklaces, stingray spears and fishing nets.

The coastal peoples of Princess Charlotte Bay and the Flinders group have been characterised by Chase & Sutton (1981) for their '*extreme sedentism*', sharing related language dialects and a specialised marine technology. They saw themselves as '*beach people*' (Hynes & Chase, 1982), as opposed to inland people, although some coastal groups have been reported to have ranged considerable distances inland (e.g., Guugu Imudyi & Koko Kandji [original spelling]) (see also Beaton, 1985; Hale & Tindale, 1933, 1934). In spite of a recognised dichotomy between inland and littoral peoples, a number of authors have thus argued against a strict division of coastal and inland peoples. Roth, for instance, writing of Aborigines to the immediate north and west of Barrow Point in an unpublished report of his trip on the schooner '*Canomie*', noted that '*... there are no hill-tribes anywhere in this hinterland (through which I travelled last November) the country beyond being more or less flat and occupied by blacks friendly and intermarriageable with the coastal ones*' (Roth, 1899a: 3-4).

To the south of Princess Charlotte Bay, the peoples from the Endeavour and Bloomfield Rivers (Cooktown region) travelled in the direction of the Laura River, where they supplied the Gugu Warra of the Laura and Jowalbinna region with red ochre, white clay, grass tree spears, and other items. In return, the Gugu Warra repayed them with the same types of items which they gave to the Kuku Rarrmul of Princess Charlotte Bay and the Flinders group.

Further to the south, Aborigines from Cape Bedford traded iron axes, iron digging sticks, nautilus shells, dilly bags, pearl shell chest ornaments and melo shells for forehead bands, kangaroo-tail sinew, kangaroo bones, quartz-tipped spears, bark troughs, and a '*rough kind of fixed grind stone*' (Roth, 1910a: 18). Trading excursions took place along the northern coastline to the Flinders River.

Roth (1902-1910e) further noted that Aborigines from Cairns and Cape Grafton followed the coastline between Port Douglas and the Mulgrave River in their trading excursions, while people from the Barron River travelled as far as Port Douglas to the north, and Kuranda and Mareeba inland to the west. Russell River Aborigines travelled to the Pyramid Mountain, the Mulgrave and Johnstone Rivers and Cairns. Aborigines from the Johnstone River, in their turn, travelled to Clump Point and Liverpool Creek.

Aborigines from Cape Grafton are reported by Roth (1910a: 19) to have traded bicornual dilly-bags to the Port Douglas, Mulgrave River, Barron River, Mareeba and Herberton districts, while grass-bugle necklaces were destined for the Mulgrave and Russel Rivers, four pronged fish spears for the Mulgrave, Upper Russel and Johnstone Rivers as well as Clump Point, straight spear-throwers without the shell-haft for the Mulgrave, Johnstone and Russel Rivers, bent or moon-shaped spear-throwers, single-handed swords and large fighting shields to the Barron River and northwards. From the north (mainly Barron River and Port Douglas), the Cape Grafton Aborigines would receive dilly bags, beeswax necklaces, straight shell-hafted spear-throwers, bamboo spears, nautilus shell necklaces and cockatoo top-knot headdresses. From the south (Mulgrave River) came long swords, boomerangs, shields, possum-string armlets, and pearl shell chest ornaments which arrived via Atherton and Herberton. These were said to have arrived from further west.

Further to the south, Roth documented other evidence for trade among coastal and rainforest peoples, stressing trading partnerships within the rainforest and coastal fringes, although external imports also took place. Along the eastern and southern coasts of Cape York Peninsula, Roth stated that trading was carried out on an individual basis, *'each doing business on his own account'* (Roth, 1910a: 19). Similarly, along the central west coast of Cape York, *'the Pennefather River Natives apparently do not carry on much in the way of trade; they travel but a comparatively short distance up and down the coast-line, and never to any great distance inland'*.

In short, Roth documented evidence for intensive but relatively short distance trading networks in northern and northeastern Queensland. Trading routes followed river valleys and the eastern coastline, with the region around and immediately south of Cooktown participating in a coastal-hinterland interaction covering most of southeast Cape York Peninsula north of the Walsh and Mitchell Rivers. Findings of a coastal sea shell in a rockshelter site in the Upper Daintree valley (see above) supports claims of close contacts between the coastal and hinterland regions of Cooktown and further west (M. David, 1989). Similarly, an elderly Mt Carbine man (Denis Ross) has reported that the Mt Carbine Aborigines foraged along the Mitchell River earlier this century (M. David pers. comm., 1991 & field notes). Dave Edwards and Charlie Mc-

Cracken, long-term European residents at Daintree and Mossman, also reported that the area between the coast and hinterland to the immediate south of Cooktown was criss-crossed by Aboriginal tracks during the early contact period (M. David pers. comm., 1989; McCracken, 1989). Such tracks are reported to have gone through Mossman Gorge, onto the tableland, and along the McLeod and Mitchell Rivers to the west, while the rainforest itself was generally avoided. Referring to the peoples of the Bloomfield River to the immediate south of Cooktown, Anderson and Robins (1988: 187) wrote of intensive, short distance travels by coastal peoples: *'... coastal movement in general was primarily north and south between the permanent camps along the coast, with forays inland up on the lower portions of the coastal ranges for inland resources. There was also clearly a great deal of travel up and down the Bloomfield River itself, and comings and goings between the upper riverine camps and the coastal ones were common according to early European accounts'*. It is partly by referring to such a pattern of movement which has led them to claim that *'the people associated with the Bloomfield riverine and coastal area were ... part of a larger cultural and linguistic bloc which included most of southeast Cape York Peninsula'* (Anderson & Robins, 1988: 186).

While there is very broad agreement in the works of Roth (1899a-1910e), Hale & Tindale (1933-4), Tindale (1974) and Sharp (1939) with respect to the location of socio-linguistic territories in southern Cape York Peninsula, the boundaries between these territories remain hazy and not uniformly defined. Hence the Gugu Warra, Kuku Yawa and Kuku Mini speakers of the Laura region have been reported by Roth (1910a) to have often moved between the various territories, while informants of Trezise (1971) endorsed the presence of Gugu Warra in the vicinity of the Normanby River, but said that the Kuku Mini occupied the Laura sandstone and the Kuku Yalanji had their camp not far from the present township of Laura.

The above observations reveal important information about the geographical locations of interacting linguistic groups. As Rigsby (1980, 1981) has noted, however, it would be a mistake to treat linguistic groups as the main component of territorial networks. He thus argued that Tindale's (1974) 'dialectal tribe' often confuses the nature of land/people/language relations in Cape York Peninsula, as different types of social groupings should be recognised. For our purposes, two such

groupings must be differentiated: the land owning group (patriclans) and the land using, residential group. At any point in time, a country will be occupied by individuals from many patriclans, and hence from numerous language groups. Because of his field methods, Tindale's (1974) dialectal tribe has often masked land/language/people relations. In effect his tribal groups are neither an accurate distribution of linguistic groups, land owning groups (especially patriclans), or land using groups, for they are an amalgamation of various social categories. Tindale's identification of bounded linguistic units, suggesting distinct but interacting language groups, masks a system of social processes which is in reality both more subtle and more complex. Nevertheless, as people from a given language area tend to interact within a limited geographical area, the locations of dialectal tribes probably roughly agree with the locations of major networks of territorial (land owning) and land using groups (which consist of relatively bounded groups of affiliated and interacting people).

The marked similarity in the dominant types of painting from Laura, Koolburra, Mitchell-Palmer, Cooktown hinterland, Princess Charlotte Bay and, to a lesser extent, Bare Hill, may reflect the close and continued ties documented for the inhabitants of these regions. The development of a single major artistic tradition to the north of the Walsh River, expressed as variations of a common theme (figurative paintings undertaken in infilled monochrome), therefore may reflect a broadly unified system of interpersonal relations, such as documented by Roth.

REGIONALISATION

The second trend which appears in the rock art is the highly regionalised nature of painting conventions within the northern and southern zones during mid to late Holocene times. In addressing such regional networks, we now turn to the ethnographic literature to investigate social processes which may have given rise to regionalised social landscapes.

To local Aboriginal people, the region is composed of a myriad of named countries owned by one or more patriclan, and land owning groups may have a series of non-contiguous territories (David & Cordell, 1993; Sutton & Rigsby, 1982: 167). Each patriclan owns totems, songs, dances etc., which also identify and differentiate it from other patriclans, other countries. Each patriclan is also identified by its own language or, rather by its own language variation (only a few words may

separate different patriclans linguistically). Individuals of one patriclan, although multilingual, usually speak the language of the country they are in (Rigsby, 1981: 93) (see also Meggitt for a similar observation amongst central Australian Aborigines). Most languages or language variations are named for the patriclans with which they are associated, as the '*language of such-and-such patriclan*' (Rigsby, 1981), but sometimes a language will have its own name. As previously noted, at any point in time a country will be occupied by individuals from a number of patriclans, and hence language groups.

A similar view has been voiced by Anderson (1984) for the Bloomfield River area of southeast Cape York Peninsula. Focusing on broader issues of interpersonal interaction, he argued that four primary social arrangements should be recognised:

- 1, the family unit, the most important primary unit of society (nuclear family),
- 2, the local descent group, bound to specific locations in the landscape, whose members are related by ties of descent and religious affiliation,
- 3, the clan, a more general and larger version of descent groups, which '*contain[s] a number of lineages linked by descent and common religious association to a presumed ancestor*' (Anderson, 1984: 54),
- 4, the horde, which consists of men associated by descent plus their wives and children and unmarried sisters — the most important economic and political unit, and clan based.

The importance of these observations is that membership in any camp relies partly on the context of interaction. As Sharp (1934a: 31) noted, '*... men of a clan are separated and do not live together in their own territory as a horde*' (see also Sharp, 1934b). Although individual affiliations may, to a large extent, be formally structured, interpersonal interaction in Cape York Peninsula is dynamic and also subject to choices that go beyond such structures. To address this adequately it is necessary to turn to the active management of territorial structures — that is, land affiliation and land use — by individuals. It is this aspect of socio-political practice which may offer important clues regarding the emergence of highly regionalised bodies of rock art during the last few thousand years.

For peoples on both sides of Cape York Peninsula, Sutton & Rigsby (1982) note that the conscious management of land affiliation actively organises people through the landscape. Both land owning and land using groups involve from

approximately 25-50 individuals (Coombs et al., 1980 make a similar argument for other parts of Australia). As the sizes of interacting populations increased, conflicts were noted to increase, and as a result groups split up into smaller units. The net effect is a process of segmentation that re-organises people through the landscape via political manipulation of territorial concerns: *'the political management of land divides over-sized land owning groups into smaller segments and ensures that lands of extinct land owning groups continue to be owned and used by successors'* (Sutton & Rigsby, 1982: 159). Along the southeastern coast of Cape York Peninsula, Anderson (1984: 94) saw geographical features — drainage basins and mountain ranges — as constraining forces that provided markers for social boundaries. Each patriline was noted to have a totem, although it was not tied to a specific location. Territorial networks in southeastern Cape York Peninsula, therefore, should not be viewed via static descent models based on patriline or matri-affiliation, but instead should be treated as dynamic, involving the manipulation of ties to land through political play (Sutton & Rigsby, 1982; see also Myers, 1986; Sutton, 1978). In this context, particular individuals are important in crystallising residence patterns, as well as in determining the course of territorial formations through the process of history (Anderson, 1984).

We would thus argue that it is by treating land use and ownership as dynamic that the regionalised nature of north Queensland's mid to late Holocene rock art can be best understood. If the fundamental differences outlined in the previous section of this monograph — those between an essentially homogeneous early rock art tradition, and regionally distinctive later one — hold firm as the chronological framework presented is refined, then it can be said that major, structural changes have taken place in the contexts of rock art creation during the last 3,000 years or so. Given that rock art is embedded in the landscape by virtue of its creation in grounded social phenomena, we would also argue that the geographical distribution of rock art styles cannot be treated independently of territorial structures (see Gamble [1982, 1986] and Jochim [1983] for European examples of a similar approach). We therefore propose that the relatively recent regionalisation of rock art in north Queensland implies a contemporaneous regionalisation of territorial networks, which in turn can be viewed as resulting from social processes such as those outlined above.

Having said this, it is recognised that some of the data upon which the above conclusions have been reached are problematical. We therefore now briefly outline some of these issues.

PROBLEMS AND LIMITATIONS

PAINTINGS VERSUS PECKINGS

In the previous section, herein, we argued that fundamental changes have taken place in the distribution of rock art conventions sometime after 3,000-2,000BP. An important difficulty has been, however, in comparing an early engraving technique with a more recent one based on painting. It is possible that these two techniques have intrinsic limitations which are significant enough to constrain the artist in different ways. For instance, it is possible that engravings are more amenable to the creation of geometric designs, while the greater plasticity of the painting medium provides the artist with a broader range of formal choices. This is considered to be unlikely, however, for two major reasons. Firstly, in some parts of Australia (e.g. the Pilbara, Western Australia, and Wardaman country, Northern Territory), engravings on hard surfaces are often figurative. Secondly, the unpatinated peckings of southeast Cape York are often figurative in form, unlike their more patinated counterparts. If the arguments presented here are correct, the rock engravings of the late Holocene, like the paintings, should also be more regionalised than are those of the early Holocene and the late Pleistocene. There are hints that this may indeed be so, as in the Amphitheatre Site where apparently recent engravings appear to follow similar conventions to those of the paintings.

TEMPORAL DEFINITION

The second problem concerns the generally poor nature of chronological definition obtained for both the rock art and the excavated materials. In future, it is anticipated that a greater understanding of the antiquity of the rock art will emerge via an increasing emphasis on AMS dates. This is now just a matter of time. The construction of better temporal frameworks for the excavated materials, however, will require different solutions.

As we have argued throughout this work, there has been a general lack of fine grained, chrono-stratigraphic data from southeast Cape York Peninsula. This has only been partially due to inadequacies inherent to the archaeological record (that is, poor stratigraphic definition). It

has also resulted from archaeological practices based on relatively coarse grained techniques and methodologies, at times involving 10cm spits, excavation grid units measuring up to 2m², and the failure to plot individual items in three-dimensions during the excavations.

These shortcomings have severely limited our ability to identify and delineate adequate temporal units by which the data can be analysed (that is, poor temporal control). As a result of this, the very reliability of the data presented has been questioned at times. These shortcomings should not be attributed so much to the methods of individual archaeological practitioners, but to methodological problems common to our time. Johnson (1979) identified a similar difficulty almost fifteen years ago when he called for a refinement of techniques. This is not an issue that requires major technological advances, but one that asks for more care to be taken during excavation. This need was highlighted above by our inability to present satisfactory fine grained temporal data from any of the published excavations undertaken in the study region.

It is therefore time for a second refinement (recognising that particular sites and questions will require different methods). As a minimum requirement, a call is made for the use of maximum 50cm x 50cm excavation grid units (with as many squares being excavated from each site as necessary), excavated in maximum 2cm (or 5 litre) spits within stratigraphic units, and with the plotting of cultural materials in three dimensions. Additional to this is a need to collect samples of sediments from every spit in each square, a practice now common in Australian archaeology. These procedures, or similarly detailed ones, are necessary if we are to refine temporal trends in Australian prehistory, although it is recognised, as Bowdler (1990, 1991) has also noted, that our ability to retrieve chronostratigraphic information is only partly a function of our retrieval methods. But unless our excavation methods are finer grained than they have been hitherto, we will not be in a position to exploit the full chronostratigraphic potential of the sites we excavate.

THE PROBLEM OF SCALE

The archaeological data presented in this monograph have been relatively coarse grained due to the broad temporal frameworks used. For instance, the engravings perhaps relate to over 30,000 years of prehistory (all we can say so far is that the majority are older than c.3,000 years old), and the paintings to more than 3,000 years.

This dual temporal division was necessary as a lack of sufficient fine grained data did not warrant a closer definition. The archaeological data, therefore, covered lengthy periods of time, measured in hundreds, even thousands, of years.

In contrast, the ethnohistorical details presented relate to periods of time shorter than an individual's life span. In a way, social interaction here is viewed within a comparatively synchronic framework (Rosenfeld, 1992). In examining the anthropological data to interpret the archaeological record, our aims were thus to identify causes of social fragmentation, processes of regionalisation which may be applicable to the patterns observed archaeologically. The above discussions were geared to explore possible social implications of the observed archaeological trends, and to derive possible explanatory models, not to test them. We therefore now conclude by presenting such a model.

TOWARDS A PREHISTORY OF SOUTHEAST CAPE YORK PENINSULA: BROADER IMPLICATIONS AND CONCLUSIONS

We have argued that the mid to late Holocene witnessed widespread cultural transformations in southeast Cape York Peninsula and beyond. This was a period of largely unprecedented change, involving the appearance of new artefact forms, new manufacturing technologies, increased painting activities, and changes in resource management strategies, food processing procedures and settlement-subsistence systems. Importantly, these alterations were not haphazard, but consistently involved increases in the numbers of sites occupied and in deposition rates within sites, as well as an increase in the range of site types. Together, they suggest an increase in the intensity of site and regional land use during the mid to late Holocene; a change in use of regional landscapes through time. These issues thus necessitate an investigation of socio-cultural (structural) concerns, especially as they relate to regional and inter-regional networks.

We have addressed such concerns by investigating stylistic behaviour in rock art in the study region and beyond, arguing that the largely quantitative archaeological changes also involved major structural changes, including a regionalisation of territorial networks. This regionalisation in rock art was itself structured, in the sense that it was seen to occur at two levels at least. At one level, a major north-south discontinuity in stylistic

tic behaviour was documented, and at a second level, within each of these major zones, the rock art was regionalised into smaller units. Although space does not permit us to explore the issue more fully, we shall argue elsewhere that this may imply a closing of information exchange networks in north Queensland during the mid to late Holocene. As noted above, the increased regionalisation of stylistic conventions in north Queensland during the mid to late Holocene may imply an increase in population densities and sizes. As Lourandos (1993: 80) noted, '... as degrees of social closure emerge ..., they may be signaled socially by aspects of territoriality, boundary maintenance, and the like'. However, we also argue that this closure does not merely imply a reduction in the sizes of interaction spheres via the imposition of formally recognised boundaries. Rather, it is the connections between regions that may have changed — that is, territorial units may have become increasingly differentiated and delineated and, in the process, inter-regional interaction may have become more formalised. In the spirit of Williams's (1982) '*a boundary is to cross*', it is argued that '*boundaries on land mark discontinuities*', such as in access or ownership to land (Williams, 1982: 148). Such structures reflect '*institutionalized means for moving from group to group. So if we find boundaries in a given case, we should not commit the frequent error of assuming that they [necessarily] enclose a defended and exclusive territory*' (Lee, 1968: 157). Given that the undertaking of rock art and the acquisition of rock art conventions were contextual, it can be assumed that the documented changes in spatial behaviour also involved changes in associated social practices, perhaps including ceremonial networks, social interaction and inter-group congregations.

Any model of change should consider points in time as resulting from immediate historical antecedents, as all change is historically positioned. The following scenario is therefore presented as a possible explanation of the archaeological record. This scenario takes into account not only the specific archaeological signatures of particular time frames, but also the archaeological changes documented above. Again, it is stressed that our aim here is not to test the model, but merely to present a possible framework of interpretation.

The earliest evidence for occupation in the region dates to >37,170BP from Ngarrabullgan Cave. Here, as in other early sites, densities of occupational materials are sparse until the mid to

late Holocene. Discard rates of all cultural materials are low, as are sedimentation rates. In most sites, charcoal and shell deposition rates are also low, although here there is the problem of preferential decay of older materials. Nevertheless, preferential decay alone does not explain the significant increases in sedimentation rates, nor in the discard of ochre and stone artefacts during the mid to late Holocene. Neither do taphonomic issues explain the increases in bone discard within the excavated limestone caves from this region, as here the bones from Pleistocene deposits show no evidence of preferential chemical or mechanical disintegration. On the contrary, early deposits often exhibit considerable amounts of non-anthropogenic bone, such as owl pellet material and cave-dwelling microfauna (e.g. small lizards, rodents).

In addition to the above, new site types make their first appearance during the mid to late Holocene, such as mounds at Princess Charlotte Bay. Rock painting activity appears to become widespread and comparatively intensive, while relatively distinct, sub-regional styles emerge from a previously more or less homogeneous engraving tradition. We argue that these trends may imply increasing intensities of land use and a regionalisation of territorial networks. The emergence of increasingly bounded regional practices may signal the development of unprecedented formally demarcated corporate groups, along with an increasing formalisation of territorial structures. We thus argue that around 3,000BP, north Queensland began to witness a closure of socio-cultural systems in association with an increase in population size and density (that is, overall demographic changes). Prior to the mid Holocene, socio-cultural systems may have been relatively open. Such systems may have been characterised by an absence of strongly formalised means by which corporate landed groups recognised exclusive access to places. That is, we would argue that during the early Holocene and the late Pleistocene, access to land was more open than during later times — territorial units (tracts of land used and/or owned) were larger. Relatively speaking, there may have been an absence (or smaller number) of pronounced and short-spaced boundaries, and therefore of essentially exclusive territorial sets, within any given area. Alternatively, mechanisms for inclusion may have been in place to transcend rules of exclusion, and these may have been commonly applied. Social and cultural variation through space, prior to the mid Holocene, was likely to

have been expressed in clinal, rather than discontinuous (punctuated) space, with the existence of mechanisms enabling intergroup interaction and affiliation at multiple social levels. In effect, one could envisage a socio-cultural system where the interconnections between social groups were at least as strong as formally recognised principles of differentiation. Under such a system, innovations would be likely to spread rapidly across space, maintaining homogeneity and restricting distinctiveness. This scenario is superficially similar to the situation presented by Myers (e.g. 1986) and others (e.g. Poirier, 1993) for recent and current Australian desert peoples such as Pintupi, Warlpiri and so forth. In such cases, innovations and introduced new ideas are quickly passed on, *'at once reinforcing sociopolitical bonds between neighbouring groups and creating new ones'* (Poirier, 1993: 769). As Poirier (1993: 769) further noted, this process does not deny social change, but testifies to a cultural dynamism that reveals intrinsic qualities of openness and flexibility. It is perhaps for this reason that Dwyer (1990: 195; see also Dwyer & Minnegal, 1992: 382) has elsewhere argued, as we have done here, that *'change in open systems occurs as they consolidate and replicate sameness'*. In making these statements, however, we do not wish to make specific comparisons between north Queensland and central Australia, since the two regions were guided by their own, and potentially separate, historical trajectories.

The emergence of relatively distinct regional networks around 3,000 years ago may have signalled an end to this conservatism. We would argue, as Barker (1995) has independently concluded, that social factors such as settlement patterns, patterns of resource exploitation and the like became more bounded in tandem with an increased formalisation of territorial boundaries. As groups became more formalised, differences between them emerged in some social fields. However, the emergence of relatively distinctive regional networks also — and perhaps paradoxically — facilitated an opening-up of structured interaction networks between neighbouring groups via the establishment of recognised, formal procedures. The emergence of distinct, regional rock art styles may have been an expression of this process.

A closure of territorial units may also have ensured a relative acceleration of change, a feature characteristic of the late archaeological records of many parts of Australia. As noted above, such a closure need not have restricted

inter-regional interaction per se, but simply formalised, to some extent, the process of interaction. Such formalisation, by definition, necessitated the creation of exclusive behavioural sets, including symbolic acts with probable material correlates (e.g. rock art). Although it is unknown which aspects of social life — linguistic, kin and so forth — this regionalisation related to, it is nevertheless likely to have affected various structural and behavioural concerns given the relatedness of the different dimensions of social life. In this way, we need to enquire further about the dynamics of society and how we can view these through time.

If the above scenario is correct, it implies that the mid to late Holocene witnessed broad demographic alterations. In saying this, it is also suggested that such changes were widespread, given the similarities of the archaeological trends in most parts of mainland Australia. By demography, we refer not only to population sizes, but also to the way people were organised on the ground — that is, to territorial and alliance systems. Changes in social organisation need to be addressed directly, for this will enable us to further enquire about the forces of change in Australian prehistory (Lourandos, 1983, 1985a). Irrespective of whether or not they are associated with environmental changes, such forces are situated within a historical context of decision-making and power relations. It is this context that is embedded within the system of social, territorial and alliance relations. And it is aspects of these relations that can be glimpsed via the structure of the archaeological record.

Elsewhere a number of authors have argued that highly regionalised rock art styles appeared in Arnhem Land during the mid to late Holocene (e.g. Lewis, 1988; Taçon, 1993). Like us, these authors have argued that a regionalisation of social networks is implicated. Unlike the arguments advanced here, however, they argued that regionalisation was caused by an amelioration of natural local environments, enabling *'Aboriginal groups ... to subsist within the confines of territories that are much smaller'* than in poorer environments (Taçon, 1993: 112). The implication is that the mid to late Holocene witnessed increases in the local biomass (that is, the potential food supply), leading people to split off into different groups (with or without population increases). The end result was that *'people were associating themselves with territories smaller than in more ancient times'* (Taçon, 1993: 119) — a regionalisation of social networks.

We would argue that this model does not apply to southeast Cape York Peninsula, although it is acknowledged that environmental change can lead people to modify their behaviour (it can lead to social change) (for an ethnographic example of this, see Dwyer & Minnegal [1992]). It is thus worth re-iterating that environmental conditions in north Queensland were at their richest, as far as biomass levels are concerned, during the wet phase of the early and mid Holocene (c.8,000 and 3,000BP). In this sense, the last 3,000 years were not climatically optimal. If regionalisation of social networks were to take place during periods of environmental amelioration, it should thus have taken place during the early to mid Holocene, not during the late Holocene. The fact that this was not so, and that there is no evidence for regionalisation during earlier episodes of environmental richness, suggests that an explanation for this social change should be sought elsewhere. In effect, we argue further that even if environmental factors were involved, we would still have to enquire into the nature of historical, social conditions to adequately address the issue. We therefore see the changes that have been documented in different aspects of the archaeological records of many parts of Australia as indicating major changes in social and cultural factors, irrespective of their ultimate stimuli or causes. Although the particular forms that these changes took must have been undertaken in the context of natural environmental conditions, we would argue that social conditions during the mid Holocene were already leading to major demographic alterations, and that this was a social dynamic not directly attributable to environmental amelioration. We would further argue that we will probably never know the ultimate cause(s) for these demographic alterations (if there are any), and that identifiable stimuli, like missing links in biological evolution, may not always be a fruitful way of looking at change. Although local environmental conditions should be treated as a circumstance in which social change takes place, we should not automatically treat the former as causing the social or cultural changes observed in the archaeological record. Rather, the nature of change may lie in the dialectics of existing social and psychological conditions, with their potential to give rise to a broad range of social actions made possible by the nature of historical precedents.

In accounting for the recent regionalisation of symbolic behaviour in north Queensland, it is thus acknowledged that the material record is

directly related to social concerns. Such concerns involve temporal and spatial issues, although the latter have often been ignored (or regarded as subordinate) in Australian prehistory. When spatial concerns have been taken into account, changes are often presented as involving processes of integration or processes of fragmentation (regionalisation). The approach presented here thus departs from previous frameworks in a significant way, for it is based on the premise that social change at once involves processes of integration and fragmentation. That is, it involves both the way that people subdivide socially into different sets (identities), and the way that these sets are linked into a broader whole. It is in the nature of the connections between social categories, and between contexts of behaviour, that we may have a window through which to better understand changes in Australian prehistory. For it is in those links, in the mediation between structural phenomena and in the formalisation of structured behaviour through time, that we may best enquire into the socio-cultural forces that led to stability and change in the prehistory of north Queensland and beyond.

LITERATURE CITED

- AHARON, P. 1983. Surface ocean temperature variations during the late Wisconsin stages: $^{16}\text{O}/^{18}\text{O}$ isotopic evidence from Papua New Guinea. Pp. 3-4. In Chappell, J. and Grindrod, A. (eds.) 1983.
- ALDENDERFER, M.F. & BLASFIELD, R.K. 1984. 'Cluster Analysis'. (Sage Publications: Beverley Hills).
- ALLEN, H. 1986. Environmental history in south-western New South Wales-northwestern Victoria during the late Pleistocene. (Unpublished paper presented at the World Archaeological Congress, Southampton).
- ALLEN, H. & BARTON, G. 1989. 'Ngarradj Warde Djokkeng: White Cockatoo Dreaming and the Prehistory of Kakadu'. (University of Sydney: Sydney).
- ALVEY, N., GALWEY, N. & LANE, P. 1982. 'An Introduction to GENSTAT'. (Academic Press: London).
- ANDERSON, A. 1978. The role of a competition model in the archaeological explanation of economic change. Pp. 31-46. In Green, D., Haselgrove C. and Spriggs, M. (eds.) 'Social Organisation and Settlement'. (British Archaeological Reports: Oxford).
- ANDERSON, C. 1984. The political and economic basis of Kuku-Yalanji social history. (Unpublished PhD thesis, University of Queensland, St. Lucia).

- ANDERSON, C. & ROBINS, R. 1988. Dismissed due to lack of evidence? Kuku-Yalanji sites and the archaeological record. Pp. 152-205. In Meehan, B. and Jones, R. (eds.) 'Archaeology with Ethnography: an Australian Perspective'. (Australian National University: Canberra).
- ARNDT, W. 1962. The interpretation of the Delamere lightning painting and rock engravings. *Oceania* 32: 163-77.
- ATTENBROW, V. 1982. The archaeology of Upper Mangrove Creek catchment: research in progress. Pp. 67-79. In Bowdler, S. (ed.) 'Coastal Archaeology in Eastern Australia'. (Australian National University: Canberra).
1986. Temporal change and regional variation in the archaeological record in eastern Australia. (Unpublished paper presented at the World Archaeological Congress, Southampton).
- BARKER, B. 1989. Nara Inlet 1: a Holocene sequence from the Whitsunday Islands, central Queensland coast. *Queensland Archaeological Research* 6: 53-76.
1991. Nara Inlet 1: coastal resource use and the Holocene marine transgression in the Whitsunday Islands, central Queensland. *Archaeology in Oceania* 20: 1-20.
1995. The Sea People: Maritime hunter-gatherers on the tropical coast - a late Holocene maritime specialisation in the Whitsunday Islands, central Queensland. (Unpublished PhD thesis, University of Queensland, St. Lucia).
- BEATON, J.M. n.d. Report on archaeological fieldwork in the Flinders Island/Bathurst Heads/Princess Charlotte Bay area, north Queensland, 1979. (Unpublished report, Australian Institute of Aboriginal Studies, Canberra).
1977. Dangerous harvest: investigations in the late prehistoric occupation of upland southeast central Queensland. (Unpublished PhD thesis, Australian National University, Canberra).
1981. Princess Charlotte Bay archaeological report: second interim report. (Unpublished report, Australian Institute of Aboriginal Studies, Canberra).
1983. Does intensification account for changes in the Australian Holocene archaeological record? *Archaeology in Oceania* 18: 94-97.
1985. Evidence for a coastal occupation time-lag at Princess Charlotte Bay (North Queensland) and implications for coastal colonization and population growth theories for Aboriginal Australia. *Archaeology in Oceania* 20: 1-20.
1990. The importance of past population for prehistory. Pp. 23-40. In Meehan, B. and White, N. (eds.) 'Hunter-Gatherer Demography: Past and Present'. (University of Sydney: Sydney).
- BEDNARIK, R.G. 1994. A taphonomy of palaeoart. *Antiquity* (in press).
- BENDER, B. 1979. Gatherer-hunter to farmer: a social perspective. *World Archaeology* 10(2): 204-222.
1992. Theorising landscapes, and the prehistoric landscapes of Stonehenge. *Man* 27(4): 735-755.
- BINFORD, L.R. 1968. Post-Pleistocene adaptations. Pp. 313-341. In Binford, S.R. and Binford, L.R. (eds.) 'New Perspectives in Archaeology'. (Aldine: Chicago).
1983. 'In Pursuit of the Past: Decoding the Archaeological Record'. (Thames & Hudson: New York).
- BINFORD, S.R. 1968. Ethnographic data and understanding the Pleistocene. Pp. 274-275. In Lee, R.B. and DeVore, I. (eds.) 'Man the Hunter'. (Aldine: New York).
- BINNS, R.A. & McBRYDE, I. 1972. 'A Petrological Analysis of Ground-Edge Artefacts from Northern New South Wales'. (Australian Institute of Aboriginal Studies: Canberra).
- BIRD, C.F.M. & FRANKEL, D. 1991. Chronology and explanation in western Victoria and southeast South Australia. *Archaeology in Oceania* 26(1): 1-16.
- BIRD, M.K. 1992. The impact of tropical cyclones on the archaeological record: an Australian example. *Archaeology in Oceania* 27(2): 75-86.
- BIRDSELL, J.B. 1957. Some population problems involving Pleistocene man. *Cold Spring Harbor Symposium on Qualitative Biology* 22: 47-69.
1967. Preliminary data on the trihybrid origin of the Australian Aborigines. *Archaeology and Physical Anthropology in Oceania* 2: 100-155.
- BIRKETT, C. 1983. Corridor or karst and creek: a site catchment analysis of Walkunder Arch Cave, near Chillagoe, north Queensland. (Unpublished B.A. [Hons.] thesis, James Cook University of North Queensland, Townsville).
1985. A site catchment analysis: Walkunder Arch Cave, near Chillagoe, north Queensland. *Queensland Archaeological Research* 2: 132-143.
- BOCHENSKI, J.M. 1963. 'The Dogmatic Principles of Soviet Philosophy as of 1958'. (D. Reidel: Dordrecht).
- BOSERUP, E. 1965. 'The Conditions of Agricultural Growth'. (Aldine: Chicago).
- BOWDLER, S. 1981. Hunters in the highlands: Aboriginal adaptations in the Eastern Australian Uplands. *Archaeology in Oceania* 16(2): 99-111.
1990. 50,000 year-old site in Australia: is it really that old? *Australian Archaeology* 31: 93.
1991. Some sort of dates at Malakunanja 2: a reply to Roberts et al. *Australian Archaeology* 32: 50-51.
- BOWLER, J. 1983. 182KA: northern Australia - hydrologic evidence. Pp. 47-48. In Chappell, J. and Grindrod, A. (eds.) 1983.
- BROOKFIELD, H.C. 1972. Intensification and disincentification in Pacific agriculture: a theoretical approach. *Pacific Viewpoint* 13: 30-48.
- BRUCE, R. 1902. 'Reminiscences of an Old Squatter'. (Thomas: Adelaide).

- CAMPBELL, J.B. 1982. New radiocarbon results for north Queensland prehistory. *Australian Archaeology* 14: 62-66.
1984. Extending the archaeological frontier: a review of work on the prehistory of north Queensland. *Queensland Archaeological Research* 1: 173-184.
- CAMPBELL, J.B. & MARDAGA-CAMPBELL, M. 1993. From micro- to nano-stratigraphy: linking vertical and horizontal dating of archaeological deposits with the direct dating of rock art at 'The Walkunders', Chillagoe (north Queensland, Australia). Pp. 57-63. In Steinbring, J., Watchman, A., Faulstich, P. and Taçon, P.S.C. (eds.) 'Time and Space: Dating and Spatial Considerations in Rock Art Research'. (Australian Rock Art Research Association: Melbourne).
- CHAPPELL, J. 1982. Sea levels and sediments: some features of the context of coastal archaeological sites in the tropics. *Archaeology in Oceania* 17: 69-78.
- CHAPPELL, J., CHIVAS, A., WALLENSKY, E., POLACH, H. & AHARON, P. 1983. Holocene palaeoenvironmental changes, central to north Great Barrier Reef inner zone. *Bureau of Mineral Resources Journal of Geology and Geophysics* 8: 223-235.
- CHAPPELL, J. & GRINDROD, A. (eds.) 1983. 'CLIMANZ: Proceedings of First CLIMANZ, February 1981'. (Australian National University: Canberra).
- CHASE, A. & SUTTON, P. 1981. Hunter-gatherers in a rich environment: Aboriginal coastal exploitation in Cape York Peninsula. Pp. 1817-1852. In Keast, A. (ed.) 'Ecological Biogeography in Australia'. (Dr. W. Junk: The Hague).
- CHILLAGOE CAVING CLUB INC. 1988. 'Mitchell-Palmer Karst: a Speleological Field Guide for the Towers and Caves of the Mitchell-Palmer Areas in Far North Queensland, Australia'. (Chillagoe Caving Club Inc.: Cairns).
- CLARK, C.M.H. 1962. 'A History of Australia, Volume 1: From the Earliest Times to the Age of Macquarie'. (Melbourne University Press: Parkville).
- CLEGG, J. 1978. Mathesis words, Mathesis pictures. (Unpublished M.A. [Hons.] thesis, University of Sydney, Sydney).
1988. Comment. *Rock Art Research* 5: 19-22.
- CLEGG, J. & FETHNEY, J. 1988. Is the Cape York painting a Diprotodontid? *Search* 19(1): 26-30.
- CLELAND, J.B. 1966. Preface. Pp. 7-8. In Cotton, B.C. (ed.) 'Aboriginal Man in South and Central Australia'. (Government Printer: Adelaide).
- COLE, N. n.d. Rock art at Agate Creek. (Unpublished report, Dept. Environment and Heritage, Brisbane).
1988. The Rock Art of Jowalbinna. (Unpublished B.A. [Hons.] thesis, James Cook University of North Queensland, Townsville).
1990. Recent rock art research at Laura, north Queensland. *Rock Art Research* 7: 142-143.
1992. 'Human' motifs in the rock paintings of Jowalbinna, Laura. Pp. 164-173. In McDonald, J. and Haskovec, I.P. (eds.) 'State of the Art: Regional Rock Art Studies in Australia and Melanesia'. (Australian Rock Art Research Association: Melbourne).
- COLE, N. & DAVID, B. 1992. 'Curious Drawings' at Cape York: a summary of rock art investigation in the Cape York Peninsula region since the 1820s and a comparison of some regional traditions. *Rock Art Research* 9(1): 3-26.
- COLE, N. & TREZISE, P. 1992. Laura engravings: a preliminary report on the Amphitheatre site. Pp. 83-88. In McDonald, J. and Haskovec, I.P. (eds.) 'State of the Art: Regional Rock Art Studies in Australia and Melanesia'. (Australian Rock Art Research Association: Melbourne).
- COLE, N. & WATCHMAN, A. 1992. Painting with plants: investigating fibres in Aboriginal rock paintings at Laura, north Queensland. *Rock Art Research* 9(1): 27-36.
- COLEMAN D. & SCHOFIELD, R. (eds.) 1986. 'The State of Population Theory'. (Basil Blackwell: Oxford).
- COMMONWEALTH DEPARTMENT OF NATIONAL DEVELOPMENT AND THE QUEENSLAND DEPARTMENT OF INDUSTRIAL DEVELOPMENT 1971. 'Resources and Industry of Far North Queensland, Australia'. (Australian Government Printing Services: Canberra).
- CONKEY, M.W. 1978. Style and information in cultural evolution: toward a predictive model for the paleolithic. Pp. 61-85. In Redman, C.L., Berman, M.J., Curtin, E.V., Langhorne, W.T. Jr., Versaggi, N.M. and Wanser, J.C. (eds.) 'Social Archaeology: Beyond Subsistence and Dating'. (Academic Press: New York).
1980. The identification of prehistoric hunter-gatherer aggregation sites: the case of Altamira. *Current Anthropology* 21: 609-630.
1982. Boundedness in art and society. Pp. 115-128. In Hodder, I. (ed.) 'Symbolic and Structural Archaeology'. (Cambridge University Press: Cambridge).
1989. The use of diversity in stylistic analysis. Pp. 118-158. In Leonard, R. and Jones, G. (eds.) 'Quantifying Diversity in Archaeology'. (Cambridge University Press: Cambridge).
1990. Experimenting with style in archaeology: some historical and theoretical issues. Pp. 5-17. In Conkey, M.W. and Hastorf, C.A. (eds.) 'The Uses of Style in Archaeology'. (Cambridge University Press: Cambridge).
- COOMBS, H.D., DEXTER, B.G. & HIATT, L.R. 1980. The outstation movement in Aboriginal Australia. *Australian Institute of Aboriginal Studies Newsletter* 14: 16-23.
- COPPINGER, R.W. 1883. 'Cruise of the Alert'. (W. Swan Sonnenschein & Co.: London).

- COSGROVE, R., ALLEN, J. & MARSHALL, B. 1990. Palaeo-ecology and Pleistocene human occupation in south-central Tasmania. *Antiquity* 64: 59-78.
- COUTTS, P.J.F. 1982. Victoria Archaeological Survey activities report 1979-80. Records of the Victorian Archaeological Survey 13: 1-28.
- COWGILL, G.L. 1975. On causes and consequences of ancient and modern population changes. *American Anthropologist* 77: 505-525.
- CRIBB, R.L.D. 1986. When the tide came in: Pleistocene-Holocene sea levels, archaeological catchments and population change in northern Australia. (Unpublished paper presented at the World Archaeological Congress, Southampton).
- CURR, E. 1886. 'The Australian Race'. (Government Printer: Melbourne).
- DAGG, L. 1992. Interpreting faunal remains: a taphonomic analysis of two late Holocene faunal assemblages from southeast Cape York Peninsula. (Unpublished B.A. [Hons.] thesis, University of New England, Armidale).
- DAVID, B. 1983. To pick a bone. (Unpublished B.A. [Hons.] thesis, Australian National University, Canberra).
- 1984a. Walkunder Arch Cave: a faunal report. *Australian Archaeology* 18(1): 40-54.
- 1984b. 'Man [sic] Versus Dingo: the Identification of Bone Remains from Archaeological Sites, with Specific Reference to Walkunder Arch Cave, Chillagoe, Northeastern Queensland'. (Department of Community Services: Brisbane).
1987. Chillagoe: from archaeology to prehistory - contributions to a late Holocene prehistory of the Chillagoe region, north Queensland. (Unpublished M.A. thesis, Australian National University, Canberra).
- 1988a. Comment. *Rock Art Research* 5(1): 22-24.
- 1988b. The rock pictures of the Chillagoe-Mungana and Mitchell-Palmer limestone belts of north Queensland: reconstructing cultural relations in north Queensland's prehistoric past. (Unpublished report, Australian Heritage Commission, Canberra).
- 1990a. Echidna's Rest, Chillagoe: a site report. *Queensland Archaeological Research* 7: 73-94.
- 1990b. How was this bone burnt? Pp. 65-79. In Solomon, S., Davidson, I. and Watson, D. (eds.) 'Problem Solving in Taphonomy: Archaeological and Palaeontological Studies from Europe, Africa and Oceania'. (University of Queensland: St. Lucia).
- 1991a. Preliminary archaeological investigations on Jackass Station, southeast Cape York Peninsula. (Unpublished report, Ang-Gnarra Aboriginal Corporation, Laura).
- 1991b. Preliminary report on Aboriginal rock art sites on Bonny Glen Station, southeast Cape York Peninsula. (Unpublished report, Wujal Wujal Community Council, Wujal Wujal).
- 1991c. Mitchell River Cave: a late Pleistocene-Holocene sequence from southeastern Cape York Peninsula. *Australian Aboriginal Studies* 1991(1): 67-72.
- 1991d. Fern Cave, rock art and social formations: rock art regionalisation and demographic changes in southeastern Cape York Peninsula. *Archaeology in Oceania* 26: 41-57.
- 1991e. Preliminary archaeological investigations at Mt. Mulligan: rock art and excavations. (Unpublished report, Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra).
- 1991f. Review of Shanks, M. and Tilley, C.'s 'Social Theory and Archaeology'. *Australian Archaeology* 32: 70-71.
- 1992a. Initial radiocarbon determinations from Nurrabullgin. *Australian Aboriginal Studies* 1992(1): 77-79.
- 1992b. Archaeological investigations at Nurrabullgin: the Mt. Mulligan Project Stage 1. (Unpublished report, Kuku Djungan Aboriginal Corporation, Mareeba).
- 1992c. Recent research in southeast Cape York Peninsula: Nurrabullgin and Mordor Cave. *Queensland Archaeological Research* 9: 50-53.
- 1992d. Analysing space: investigating context and meaning in the rock paintings of the Chillagoe-Mungana limestone belt of north Queensland. Pp. 159-163. In McDonald, J. and Haskovec, I.P. (eds.) 'State of the Art: Regional Rock Art Studies in Australia and Melanesia'. (Australian Rock Art Research Association: Melbourne).
- 1993a. Nurrabullgin Cave: the 1993 excavations. (Unpublished report, Kuku Djungan Aboriginal Corporation, Mareeba).
- 1993b. Nurrabullgin Cave: preliminary results from a pre-37,000 year old rockshelter, north Queensland. *Archaeology in Oceania* 28(1): 50-54.
1994. A Space-Time Odyssey. (Unpublished PhD thesis, University of Queensland, St. Lucia).
- DAVID, B. & COLE, N. 1990. Rock art and inter-regional interaction in northeastern Australian prehistory. *Antiquity* 64: 788-806.
1989. 'Curious drawings' and 'tolerable figures': investigating the prehistory of Cape York Peninsula and beyond through an examination of its rock art. (Unpublished manuscript held by authors).
- DAVID, B. & CORDELL, J. 1993. Mitchell River Delta Cultural Site Mapping Project: 1992. (Unpublished report, Kowanyama Land and Natural Resource Management Office, Kowanyama).
- DAVID B. & DAVID, M. 1988. Rock pictures of the Chillagoe-Mungana limestone belt, north Queensland. *Rock Art Research* 5(2): 147-156.
- DAVID, B., DAVID, M., FLOOD, J. & FROST, R. 1990a. Rock paintings of the Yingalarri region: preliminary results and implications for an archaeology of inter-regional relations in northern

- Australia. *Memoirs of the Queensland Museum* 28(2): 443-462.
- DAVID B. & FLOOD, J. 1991. On form and meaning in rock art research. *Rock Art Research* 8(2): 130-131.
- DAVID, B., McNIVEN, I., FLOOD, J., AT-TENBROW, V. & FROST, R. 1990b. The Lightning Brother's Project: 1988 and 1989 field seasons. *Australian Archaeology* 31: 86-92.
- DAVID B. & STANISIC, J. 1991. Land snails from Australian archaeological sites: initial results from Echidna's Rest (north Queensland). *The Artefact* 14: 19-24.
- DAVID, M. 1989. An archaeological survey of the Mt. Carbine and Mt. Windsor tablelands region, northeast Queensland. Conducted as part of the ANZSES 'Devil's Thumb' expedition, 1988-1989. (Unpublished report, Archaeology Branch, Brisbane).
1990. Beyond the Calamus: an archaeological survey of the Mount Carbine Tableland and Bakers Blue Mountain region, conducted as part of the ANZSES 'Daintree Falls' expedition, 1989-1990. (Unpublished report, Archaeology Branch, Brisbane).
- DAVIS, W. 1990. Style and history in art history. Pp. 18-31. In Conkey, M.W. and Hastorf, C.A. (eds.) 'The Uses of Style in Archaeology'. (Cambridge University Press: Cambridge).
- DAVISON, M.L. 1983. 'Multidimensional Scaling'. (Wiley: New York).
- DAY, R.W., WHITAKER, W.G., MURRAY, C.G., WILSON, I.H. & GRIMES, K.G. 1983. 'Queensland Geology: a Companion Volume to the 1:2,500,000 Scale Geological Map (1975)'. (Government Printer: Brisbane).
- DE KEYSER, F. & LUCAS, K.G. 1968. 'Geology of the Hodgkinson and Laura Basins, North Queensland'. (Bureau of Mineral Resources: Canberra).
- DE KEYSER, F. & WOLFF, K.W. 1964. 'The geology and mineral resources of the Chillagoe area, Queensland'. (Bureau of Mineral Resources: Canberra).
- DOWNEY, B. & FRANKEL, D. 1992. Radiocarbon and thermoluminescence dating of a central Murray mound. *The Artefact* 15: 31-35.
- DRAGOVICH, D. 1981. Cavern microclimates in relation to preservation of rock art. *Studies in Conservation* 26: 143-149.
1984. Varnished engraving and rock weathering near Broken Hill, Western N.S.W. *Australian Archaeology* 18: 55-62.
1986. Minimum age of some desert varnish near Broken Hill, N.S.W. *Search* 17: 149-151.
1987. Desert varnish and problems of dating rock engravings in western New South Wales. Pp. 28-35. In Ambrose, W.R. and Mummery, J.M.J. (eds.) 'Archaeometry: Further Australian Studies'. (Australian National University: Canberra).
- DWYER, P.D. 1990. 'The Pigs that Ate the Garden: a Human Ecology from Papua New Guinea'. (University of Michigan Press: Ann Arbor).
- DWYER, P.D. & M. MINNEGAL 1992. Cassowaries, chickens and change: animal domestication by Kubo of Papua New Guinea. *The Journal of the Polynesian Society* 101(4): 373-385.
- EDWARDS, ROBERT 1966. Comparative study of rock engravings in south and central Australia. *Transactions of the Royal Society of South Australia* 90: 33-38.
1971. Art and Aboriginal prehistory. Pp. 356-367. In Mulvaney, D.J. and Golson, J. (eds.) 'Aboriginal Man and Environment in Australia'. (Australian National University Press: Canberra).
- EDWARDS, RON 1967. Aboriginal art at Mt. Muligan. *Northern Folk* 16: 6-7.
- EVERITT, B. 1974. 'Cluster Analysis'. (Heinemann Educational Books: London).
- FAULSTICH, P. 1986. Spirits on the rock: symbol and structure in north Queensland rock paintings. *American Indian Rock Art* 10: 21-30.
- FLOOD, J. 1983. 'Archaeology of the Dreamtime'. (William Collins: Sydney).
1987. Rock art of the Koolburra Plateau, north Queensland. *Rock Art Research* 4(2): 91-126.
- FLOOD, J., DAVID, B. & FROST, R. 1992. Dreaming into art: Aboriginal interpretations of rock engravings - Yingalarri, Northern Territory, Australia. Pp. 33-38. In Morwood, M. and Hobbs, D.R. (eds.) 'Rock Art and Ethnography'. (Australian Rock Art Research Association: Melbourne).
- FLOOD, J., DAVID, B., MAGEE, J. & ENGLISH, B. 1987. Birrigai: a Pleistocene site in the southeastern highlands. *Archaeology in Oceania* 22: 9-26.
- FLOOD, J. & HORSFALL, N. 1986. Excavation of Green Ant and Echidna shelters, Cape York Peninsula. *Queensland Archaeological Research* 3: 4-64.
- FLUGLEL, E. 1982. 'Microfacies Analysis of Limestones'. (Springer Verlag: Berlin).
- FRANKEL, D. 1988. Characterising change in prehistoric sequences: a view from Australia. *Archaeology in Oceania* 23: 41-48.
1991. 'Remains to be Seen: Archaeological Insights into Australian Prehistory'. (Longman Cheshire: Melbourne).
- FRANKLAND, K. 1990. Booral: a preliminary investigation of an archaeological site in the Great Sandy Strait region, southeast Queensland. (Unpublished B.A. [Hons.] thesis, University of Queensland, St. Lucia).
- FRANKLIN, N.R. 1986. Stochastic vs. emblematic: an archaeologically useful method for the analysis of style in Australian rock art. *Rock Art Research* 3: 121-140.
1988. Comment. *Rock Art Research* 5: 24-28.

1992. Explorations of Variability in Australian Prehistoric Rock Engravings. (Unpublished PhD thesis, La Trobe University, Bundoora).
- FROST, R., DAVID, B. & FLOOD, J. 1992. Pictures in transition: discussing the interaction of visual forms and symbolic contents in Wardaman rock pictures. Pp. 27-32. In Morwood, M. and Hobbs, D.R. (eds.) 'Rock Art and Ethnography in Australia'. (Australian Rock Art Research Association: Melbourne).
- GALLOWAY, R.W., GUNN, R.H. & STORY, R. 1970. Lands of the Mitchell-Normanby area. C.S.I.R.O. Queensland Land Research Series 26.
- GAMBLE, C.S. 1979. Hunting strategies in the Central European Palaeolithic. *Proceedings of the Prehistoric Society* 45: 35-52.
1982. Interaction and alliance in palaeolithic society. *Man* 17: 92-107.
1983. Culture and society in the upper palaeolithic of Europe. Pp. 201-211. In Bailey, G.N. (ed.) 'Hunter-Gatherer Economy in Prehistory'. (Cambridge University Press, Cambridge).
1984. Regional variation in hunter-gatherer strategy in the upper Pleistocene of Europe. Pp. 237-260. In Foley, R. (ed.) 'Hominid Evolution and Community Ecology'. (Academic Press: London).
1986. 'The Palaeolithic Settlement of Europe'. (Cambridge University Press: Cambridge).
- GINGERICH, P.D. 1983. Rates of evolution: effects of time and temporal scaling. *Science* 222: 159-161.
- GODFREY, M.C.S. 1989. Shell midden chronology in southwestern Victoria: reflections of change in prehistoric population and subsistence? *Archaeology in Oceania* 24: 65-79.
- GOLLAN, K. 1984. Prehistoric dingo. (Unpublished PhD thesis, Australian National University, Canberra).
- GOLSON, J. 1977. 'The Ladder of Social Evolution: Archaeology and the Bottom Rungs'. (Sydney University Press: Sydney).
- GOSDEN, C. 1989. Prehistoric social landscapes of the Arawe Islands, West New Britain Province, Papua New Guinea. *Archaeology in Oceania* 24(2): 45-58.
- GOULD, R.A. 1977. Puntjutjarpa rockshelter and the Australian Desert culture. *Anthropological Papers of the American Museum of Natural History* 54(1).
- HALE, H. & TINDALE, N.B. 1930. Notes on some human remains in the Lower Murray Valley, South Australia. *Records of the South Australian Museum* 4: 145-218.
1933. Aborigines of Princess Charlotte Bay. *Records of the South Australian Museum* 5(1): 64-116.
1934. Aborigines of Princess Charlotte Bay. *Records of the South Australian Museum* 5(2): 117-172.
- HALL, J. 1982. Sitting on the crop of the bay: an historical and archaeological sketch of Aboriginal settlement and subsistence in Moreton Bay, southeast Queensland. Pp. 79-95. In Bowdler, S. (ed.) 'Coastal Archaeology in Eastern Australia'. (Australian National University: Canberra).
- HALL, J. & HISCOCK, P. 1988. The Moreton Region Archaeological Project (MRAP) - Stage 2: an outline of objectives and methods. *Queensland Archaeological Research* 5: 4-24.
- HALLAM, S.J. 1977. Topographic archaeology and artifactual evidence. Pp. 169-177. In Wright, R.V.S. (ed.) 'Stone Tools as Cultural Markers: Change, Evolution and Complexity'. (Australian Institute of Aboriginal Studies: Canberra).
- HANN, W. 1873. Copy of the diary of the northern expedition under the leadership of Mr. William Hann. *Queensland Parliamentary Papers* 1873: 1-26.
- HARTIGAN, J. 1975. 'Clustering Algorithms'. (Wiley: New York).
- HASSAN, F.A. 1981. 'Demographic Archaeology'. (Academic Press: New York).
- HEAD, L. 1987. The Holocene prehistory of a coastal wetland system: Discovery Bay, southeastern Australia. *Human Ecology* 15: 435-462.
1989. Using palaeoecology to date Aboriginal fishtraps at Lake Condah, Victoria. *Archaeology in Oceania* 24: 110-115.
- HISCOCK, P. 1981. Comments on the use of chipped stone artefacts as a measure of 'intensity of site usage'. *Australian Archaeology* 13: 30-34.
1982. A technological analysis of quartz assemblages from the south coast. In Bowdler, S. (ed.) 'Coastal Archaeology of Eastern Australia'. (Australian National University: Canberra).
- 1984a. Preliminary report on the stone artefacts from Colless Creek cave, northwestern Queensland. *Queensland Archaeological Research* 1: 120-151.
- 1984b. Aboriginal site selection at one outlier on Lawn Hill station, northwestern Queensland. *Queensland Archaeological Research* 1: 152-163.
1985. The need for a taphonomic perspective in stone artefact analysis. *Queensland Archaeological Research* 2: 82-97.
1986. Technological change in the Hunter River valley and the interpretation of late Holocene change in Australia. *Archaeology in Oceania* 21(1): 40-50.
1989. Prehistoric Settlement Patterns and Artefact Manufacture at Lawn Hill, Northwest Queensland. (Unpublished PhD thesis, University of Queensland, St. Lucia).
1993. Bondaian technology in the Hunter Valley, New South Wales. *Archaeology in Oceania* 28(2): 65-76.
- HISCOCK, P. & HALL, J. 1988. Technological change at Bushranger's Cave (LA:A11), southeast Queensland. *Queensland Archaeological Research* 5: 90-112.
- HISCOCK, P. & KERSHAW, P. 1992. Palaeoenvironments and prehistory of Australia's tropical Top

- End. Pp. 43-75. In Dodson, J. (ed.) 'The Naive Lands: Prehistory and Environmental Change in Australia and the Southwest Pacific'. (Longman Cheshire: Melbourne).
- HISCOCK, P. & VETH, P. 1991. Change in the Australian desert culture: a reanalysis of tulas from Puntutjarpa rockshelter. *World Archaeology* 22(3): 332-345.
- HODDER, I. 1978. The maintenance of group identities in the Baringo district, Western Kenya. Pp. 47-73. In Green, D., Haselgrove, C. and Spriggs, M. (eds.) 'Social Organisation and Settlement'. (British Archaeological Reports: Osney Mead).
1981. Society, economy and culture: an ethnographic case study amongst the Lozi. Pp. 67-96. In Hodder, I., Isaac, G. and Hammond, N. (eds.) 'Pattern of the Past: studies in honour of David Clarke'. (Cambridge University Press: Cambridge).
- 1986a. 'Symbols in Action'. (Cambridge University Press: Cambridge).
- 1986b. 'Reading the Past'. (Cambridge University Press: Cambridge).
1987. The contextual analysis of symbolic meanings. Pp. 1-10. In Hodder, I. (ed.) 'The Archaeology of Contextual Meanings'. (Cambridge University Press: Cambridge).
- HOPLEY, D. 1983. Evidence of 15,000 years of sea level change in tropical Queensland. Pp. 93-104. In Hopley, D. (ed.) 'Australian Sea Levels in the Last 15,000 Years: a Review'. (James Cook University of North Queensland: Townsville).
- HORSFALL, N. 1987. Living in rainforest: the prehistoric occupation of north Queensland's humid tropics. (Unpublished PhD thesis, James Cook University of North Queensland, Townsville).
- HOSSFELD, P.S. 1966. Antiquity of man in Australia. Pp. 59-96. In Cotton, B.C. (ed.) 'Aboriginal Man in South and Central Australia'. (Government Printer: Adelaide).
- HOWITT, A.W. 1904. 'The Native Tribes of Southeast Australia'. (Macmillan: London).
- HUCHET, B. 1990a. A taphonomic analysis of the faunal assemblage from Yam Camp Rockshelter, southeast Cape York Peninsula. *Queensland Archaeological Research* 7: 57-72.
- 1990b. The identification of cicatrices depicted on anthropomorphs in the Laura region, north Queensland. *Rock Art Research* 7: 27-43.
1991. The nature of analogies in Australian archaeology. *The Artefact* 14: 3-12.
- HUGHES, P.J. 1977. A geomorphological interpretation of selected archaeological sites in southern coastal New South Wales. (Unpublished PhD thesis, University of NSW, Sydney).
1983. Colless Creek rockshelter archaeological site, NW Queensland, 18KA. Pp. 59-61. In Chappell, J. and Grindrod, A. (eds.) 1983.
- HUGHES, P.J. & DJOHADZE, V. 1980. 'Radiocarbon Dates from Archaeological Sites on the South Coast of New South Wales and the Use of Depth/Age Curves'. (Australian National University: Canberra).
- HUGHES, P.J. & LAMPERT, R. 1982. Prehistoric population change in southern coastal New South Wales. Pp. 16-28. In Bowdler, S. (ed.) 'Coastal Archaeology of Eastern Australia'. (Australian National University: Canberra).
- HUGHES, P.J. & SULLIVAN, M.E. 1981. Aboriginal burning and late Holocene geomorphic events in eastern NSW. *Search* 12: 277-278.
- HYNES, R.A. & CHASE, A.K. 1982. Plants, sites and domiculture: Aboriginal influence on plant communities in Cape York Peninsula. *Archaeology in Oceania* 17: 38-50.
- INGOLD, T. 1980. 'Hunters, Pastoralists and Ranchers'. (Cambridge University Press: Cambridge).
1991. Notes on the foraging mode of production. Pp. 269-285. In Ingold, T., Riches, D. and Woodburn, J. (eds.) 'Hunters and Gatherers: History, Evolution and Social Change'. (Berg: New York).
- JACK, R.L. 1895. Aboriginal cave drawings on the Palmer goldfields. *Proceedings of the Royal Society of Queensland* 11: 1-8.
- JOCHIM, M.A. 1983. Palaeolithic cave art in ecological perspective. Pp. 212-219. In Bailey, G.N. (ed.) 'Hunter-Gatherer Economy and Prehistory'. (Cambridge University Press: Cambridge).
- JOHNSON, I. 1979. The getting of data. (Unpublished PhD thesis, Australian National University, Canberra).
- JONES, R. 1968. The geographical background to the arrival of man in Australia and Tasmania. *Archaeology and Physical Anthropology in Oceania* 3: 186-215.
1976. Tasmania: aquatic machines and off-shore islands. Pp. 235-263. In Sieveking, G. de G., Longworth I.H. and Wilson, K.E. (eds.) 'Problems in Economic and Social Archaeology'. (Duckworth: London).
1978. Why did the Tasmanians stop eating fish? Pp. 11-48. In Gould, R. (ed.) 'Explorations in Ethnoarchaeology'. (University of New Mexico Press: Albuquerque).
1985. Archaeological conclusions. Pp. 291-298. In Jones, R. (ed.) 'Archaeological Research in Kakadu National Park'. (Australian National Parks and Wildlife Service: Canberra).
- KAMMINGA, J. 1982. 'Over The Edge'. (University of Queensland: Brisbane).
- KEEN, I. 1977. Yolngu sand sculptures in context. Pp. 165-183. In Ucko, P. (ed.) 'Form in Indigenous Art: schematisation in the art of Aboriginal Australia and prehistoric Europe'. (Australian Institute of Aboriginal Studies: Canberra).
- KERSHAW, P. 1970. A pollen diagram from Lake Euramoo, north-east Queensland, Australia. *New Phytologist* 69: 785-805.

1971. A pollen diagram from Quincan Crater, north-east Queensland, Australia. *New Phytolith* 70: 669-681.
1974. A long continuous pollen sequence from north-eastern Australia. *Nature* 251: 222-223.
- 1975a. Late Quaternary vegetation and climate in northeastern Australia. Pp. 181-187. In Suggate, R.P. and Cresswell, M.M. (eds.) 'Quaternary Studies'. (The Royal Society of New Zealand: Wellington).
- 1975b. Stratigraphy and pollen analysis of Bromfield Swamp, northeastern Queensland, Australia. *New Phytolith* 75: 173-191.
1993. Palynology, biostratigraphy and human impact. *The Artefact* 16: 12-18.
- KING, P. 1837. 'Narrative of a Survey of the Inter-Tropical and Western Coasts of Australia Performed Between the Years 1818 and 1822'. (Murray: London).
- KRUSKAL, J.B. & WISH, M. 1978. 'Multidimensional Scaling'. (Sage Publications: Beverley Hills).
- LAMB, L. 1993. Fern Cave: a technological investigation of increased stone artefact deposition rates. (Unpublished B.A. [Hons.] thesis, University of Queensland, St. Lucia).
- LAMPERT, R.J. 1980. Variation in Australia's Pleistocene stone industries. *Journal de la Société des Océanistes* 36(68): 190-206.
1981. 'The Great Kartan Mystery'. (Australian National University: Canberra).
- LAMPERT, R.J. & HUGHES, P. 1974. Sea level change and Aboriginal coastal adaptation in southern New South Wales. *Archaeology and Physical Anthropology in Oceania* 9: 226-235.
- LAWRENCE, D. 1994. Customary exchange across Torres Strait. *Memoirs of the Queensland Museum* 34(2): 241-446.
- LAYTON, R. 1992. 'Australian Rock Art: a New Synthesis'. (Cambridge University Press: Cambridge).
- LAYTON, R., FOLEY, R. & WILLIAMS, E. 1991. The transition between hunting and gathering and the specialized husbandry of resources: a socio-ecological approach. *Current Anthropology* 32(3): 255-274.
- LEE, R.B. 1968. Discussion on 'territorial boundaries'. P. 156. In Lee, R.B. and DeVore, I. (eds.) 'Man the Hunter'. (Aldine: New York).
1972. The intensification of social life among the !Kung Bushmen. Pp. 343-350. In Spooner, B. (ed.) 'Population Growth: Anthropological Implications'. (Massachusetts Institute of Technology: Cambridge).
- LEICHHARDT, L. 1847. 'Journal of an Overland Expedition in Australia'. (T. & W. Boone: London).
- LEROI-GOURHAN, A. 1958. La fonction des signes dans les sanctuaires paléolithiques. *Bulletin de la Société Préhistorique Française* 55: 307-321.
1968. 'The art of Prehistoric Man in Western Europe'. (Thames & Hudson: London).
- LEWIS, D. 1988. 'The Rock Paintings of Arnhem Land, Australia: Social, Ecological and Material Culture Change in the Post-Glacial Period'. (British Archaeological Reports: Osney Mead).
- LILLEY, I. 1986. Open site survey of Koolburra Plateau, Cape York Peninsula, Queensland. *Archaeological Research* 3: 65-71.
- L'OSTE-BROWN, S. 1992. Getting organised: causes of stone artefact variability in southeast Cape York Peninsula. (Unpublished B.A. [Hons.] thesis, University of New England, Armidale).
- LOURANDOS, H. 1977. Aboriginal spatial organization and population: southwestern Victoria reconsidered. *Archaeology and Physical Anthropology in Oceania* 12: 202-225.
- 1980a. Forces of change: Aboriginal technology and population in southwestern Victoria. (Unpublished PhD thesis, University of Sydney, Sydney).
- 1980b. Change or stability? Hydraulics, hunter-gatherers and population in temperate Australia. *World Archaeology* 11: 245-266.
1983. Intensification: a late Pleistocene-Holocene archaeological sequence from southwestern Victoria. *Archaeology in Oceania* 18: 81-94.
1984. Changing perspectives in Australian prehistory: a reply to Beaton. *Archaeology in Oceania* 19: 29-33.
- 1985a. Problems with the interpretation of late Holocene changes in Australian prehistory. *Archaeology in Oceania* 20: 37-39.
- 1985b. Intensification and Australian prehistory. Pp. 385-423. In Price, T.D. and Brown, J.A. (eds.) 'Prehistoric Hunter-Gatherers: the Emergence of Cultural Complexity'. (Academic Press: Orlando).
1991. Palaeopolitics: resource intensification in Aboriginal Australia and Papua New Guinea. Pp. 148-160. In Ingold, T., Riches, D. and Woodburn, J. (eds.) 'Hunters and Gatherers: History, Evolution and Social Change'. (Berg: New York).
1993. Hunter-gatherer cultural dynamics: long- and short-term trends in Australian prehistory. *Journal of Archaeological Research* 1(1): 67-88.
- MALTHUS, T. 1982a [1798]. An essay on the principle of population. Pp. 61-217. In Malthus, T. (ed.) 'An Essay on the Principle of Population'. (Penguin Books: Harmondsworth).
- 1982b [1830]. A summary view of the principle of population. Pp. 221-272. In Malthus, T. (ed.) 'An Essay on the Principle of Population'. (Penguin Books: Harmondsworth).
- MARDAGA-CAMPBELL, M. 1986. Prehistoric living-floors and evidence for them in north Queensland rockshelters. *Australian Archaeology* 23: 42-61.
- MARX, K. 1947. 'The German Ideology'. (International Publishers: New York).
- MAYNARD, L. 1976. An archaeological approach to the study of Australian rock art. (Unpublished MA thesis, University of Sydney, Sydney).

1977. Classification and terminology of Australian rock art. Pp. 387-402. In Ucko, P. (ed.) 'Form in Indigenous Art: schematisation in the art of Aboriginal Australia and prehistoric Europe'. (Australian Institute of Aboriginal Studies: Canberra).
1979. The archaeology of Australian Aboriginal art. Pp. 83-100. In Mead, S.M. (ed.) 'Exploring the Visual Arts of Oceania'. (University of Hawaii Press: Honolulu).
- McBRYDE, I. 1974. 'Aboriginal Prehistory in New England'. (Sydney University Press: Sydney).
1976. Subsistence patterns in New England prehistory. University of Queensland Occasional Papers in Anthropology 6: 48-68.
1978. *Wil-im-ee Moor-ring*: or, where do axes come from? *Mankind* 11(3): 354-382.
1984. Kulin greenstone quarries: the social contexts of production and distribution for the Mt. William site. *World Archaeology* 16: 267-285.
- McBRYDE, I. & G. HARRISON 1981. Valued good or valuable stone? Consideration of some aspects of the distribution of greenstone artefacts in southeastern Australia. Pp. 183-208. In Leach, F. and Davidson, J. (eds.) 'Archaeological Studies of Pacific Stone Resources'. (British Archaeological Reports: Oxford).
- McBRYDE, I. & WATCHMAN, A. 1976. The distribution of greenstone axes in southeastern Australia: a preliminary report. *Mankind* 10: 163-174.
- McCARTHY, F.D. 1943. An analysis of the knapped implements from eight *elouera* industry stations on the south coast of New South Wales. *Records of the Australian Museum* 21(3): 127-153.
1964. The archaeology of the Capertee Valley, New South Wales. *Records of the Australian Museum* 26(6): 197-246.
1968. Recording art on rock surfaces. Pp. 125-156. In Mulvaney, D.J. (ed.) 'Australian Archaeology: a Guide to Field Techniques'. (Australian Institute of Aboriginal Studies: Canberra).
1988. Rock art sequences: a matter of clarification. *Rock Art Research* 5: 16-42.
- McCRACKEN, C.R. 1989. Some Aboriginal walking tracks and camp sites in the Douglas Shire, north Queensland. *Queensland Archaeological Research* 6: 103-113.
- McDONALD, J. 1988. Comment. *Rock Art Research* 5: 28-30.
- McNIVEN, I. 1990. Prehistoric Aboriginal settlement and subsistence in the Cooloolo region, coastal southeast Queensland. (Unpublished PhD thesis, University of Queensland, St. Lucia).
1991. Teewah Beach: new evidence for Holocene coastal occupation in southeast Queensland. *Australian Archaeology* 33: 14-27.
- 1992a. Shell middens and mobility: the use of off-site faunal remains, Queensland, Australia. *Journal of Field Archaeology* 19(4): 495-508.
- 1992b. Bevel-edged tools from coastal southeast Queensland. *Antiquity* 66: 701-709.
- McNIVEN, I., DAVID, B. & FLOOD, J. 1992. Delamere 3: further excavations at Yiwarrarlal (Lightning Brothers Site), Northern Territory. *Australian Aboriginal Studies* 1992(1): 67-73.
- MEGGITT, M.J. 1962. 'Desert People'. (Angus & Robertson: Sydney).
- MERLAN, F. 1989a. The interpretive framework of Wardaman rock art: a preliminary report. *Australian Aboriginal Studies* 1989(2): 14-24.
- 1989b. Survey of Aboriginal sites in the northwest of the Northern Territory. (Unpublished report, Australian Heritage Commission, Canberra).
- MESTON, A. 1895. 'Geographic History of Queensland'. (Government Printer: Brisbane).
- MORPHY, H. 1977. Too many meanings: an analysis of the artistic system of the Yolngu of northeast Arnhem Land. (Unpublished PhD thesis, Australian National University, Canberra).
1991. 'Ancestral Connections: Art and an Aboriginal System of Knowledge'. (University of Chicago Press: Chicago).
- MORWOOD, M.J. 1979. Art and stone: a prehistory of central western Queensland. (Unpublished PhD thesis, Australian National University, Canberra).
1981. Archaeology of the Central Queensland Highlands: the stone component. *Archaeology in Oceania* 16(1): 1-52.
1985. Facts and figures: notes on rock art in the Mt. Isa area, northwestern Queensland. *Rock Art Research* 2(2): 140-145.
1986. The archaeology of art: excavations at Maidenwell and Gatton shelters, southeast Queensland. *Queensland Archaeological Research* 3: 88-132.
1987. The archaeology of social complexity in southeast Queensland. *Proceedings of the Prehistoric Society* 53: 337-350.
- 1989a. The archaeology of Aboriginal art in southeast Cape York: a research proposal. *Rock Art Research* 6: 71-72.
- 1989b. The archaeology of Aboriginal art in southeast Cape York: preliminary report on the 1989 fieldwork. *Rock Art Research* 6: 155-156.
- 1990a. Edge-ground axes in Pleistocene Greater Australia - more evidence from southeast Cape York Peninsula: a reply to Sutton. *Queensland Archaeological Research* 7: 110-114.
- 1990b. The prehistory of Aboriginal landuse on the upper Flinders River, North Queensland Highlands. *Queensland Archaeological Research* 7: 3-40.
1992. Changing art in a changing landscape: a case study from the upper Flinders region of the North Queensland Highland. Pp. 60-70. In McDonald, J. and Haskovec, I.P. (eds.) 'State of the Art: Regional Rock Art Studies in Australia and Melanesia'. (Australian Rock Art Research Association: Melbourne).
- MORWOOD, M.J. & GODWIN, L. n.d. Aboriginal sites in the Hughenden region, North Queensland Highlands: research prospects. (Unpublished

- report, Dept. of Environment and Heritage, Brisbane).
- MORWOOD, M.J. & TREZISE, P. 1989. Edge-ground axes in Pleistocene Greater Australia: new evidence from southeast Cape York Peninsula. *Queensland Archaeological Research* 6: 77-90.
- MOWAT, F. 1989. *Bushrangers Cave: a faunal analysis*. (Unpublished B.A. [Hons.] thesis, University of Queensland, St. Lucia).
- MULVANEY, D.J. 1975. 'The Prehistory of Australia'. (Penguin: Harmondsworth).
1976. 'The chain of connection': the material evidence. Pp. 72-94. In Peterson, N. (ed.) 'Tribes and Boundaries in Australia'. Australian Institute of Aboriginal Studies: Canberra.
- MULVANEY, D.J. & JOYCE, E.B. 1965. Archaeological and geomorphological investigations on Mt. Moffat Station, Queensland, Australia. *Proceedings of the Prehistoric Society* 31: 147-212.
- MUNN, N.D. 1970. The transformation of subjects into objects in Warlpiri and Pitjantjatjara myth. Pp. 141-156. In Berndt, R.M. (ed.) 'Australian Aboriginal Anthropology'. (University of Western Australia Press: Perth).
1973. 'Walbiri Iconography: Graphic Representation and Cultural Symbolism in a Central Australian Society'. (Cornell University Press: Ithaca).
- MYERS, F. 1986. 'Pintupi Country, Pintupi Self: Sentiment, Place and Politics among Western Desert Aborigines'. (Australian Institute of Aboriginal Studies: Canberra).
- NEAL, R. & STOCK, E. 1986. Pleistocene occupation in the southeast Queensland coast region. *Nature* 323: 618-621.
- NEGEREVICH, T. 1979. A report on the Bathurst Bay/Flinders Island Group area. (Unpublished report, Dept. Environment and Heritage, Brisbane).
- NEUMANN, A.C. 1972. Quaternary sea level history of Bermuda and the Bahamas. *American Quaternary Association Second National Conference Abstracts* 1972: 41-44.
- NIX, A. & KALMA, J.D. 1972. Climate as a dominant control in the biogeography of northern Australia and New Guinea. Pp. 61-92. In Walker, D. (ed.) 'Bridge and Barrier: the Natural and Cultural History of Torres Strait'. (Australian National University: Canberra).
- NOVELLO, M. 1989. A taphonomic analysis of the faunal remains from Platypus Rockshelter (KB:A70), southeast Queensland. (Unpublished B.A. [Hons.] thesis, University of Queensland, St. Lucia).
- O'CONNOR, S. 1992. The timing and nature of prehistoric island use in northern Australia. *Archaeology in Oceania* 27(2): 49-60.
- PARDOE, C. 1988. The cemetery as symbol: the distribution of prehistoric Aboriginal burial grounds in southeastern Australia. *Archaeology in Oceania* 23: 1-16.
1992. Wamba yadu, a late Holocene cemetery of the central River Murray. *Archaeology in Oceania* 28(2): 77-84.
- PEARCE, R.H. 1973. Uniformity of the Australian backed blade tradition. *Mankind* 9: 89-95.
1974. Spatial and temporal distribution of Australian backed blades. *Mankind* 9: 300-309.
- PEARSON, W. 1989. A technological analysis of stone artefacts from Yam Camp surface scatter and rockshelter, southeast Cape York. *Queensland Archaeological Research* 6: 91-102.
- PETERSON, N. 1976. Introduction. Pp. 1-11. In Peterson, N. (ed.) 'Tribes and Boundaries in Australia'. (Australian Institute of Aboriginal Studies: Canberra).
- PETRIE, C.C. 1904. 'Tom Petrie's Reminiscences of Early Queensland'. (Watson: Brisbane).
- POINER, G. 1976. The process of the year among the Aborigines of the central and south coast of New South Wales. *Archaeology and Physical Anthropology in Oceania* 11: 186-206.
- POIRIER, S. 1993. 'Nomadic' rituals: networks of ritual exchange between women of the Australian Western Desert. *Man* (n.s.) 27: 757-776.
- REYNOLDS, H. 1982. 'The Other Side of the Frontier: Aboriginal Resistance to the European Invasion of Australia'. (Penguin Books: Ringwood).
- RICHARDS, F. 1926. Customs and language of the western Hodgkinson Aborigines. *Memoirs of the Queensland Museum* 8(3): 249-265.
- RIGSBY, B. 1980. Land, language and people in the Princess Charlotte Bay area. Pp. 89-94. In Stevens, N.C. and Bailey, A. (eds.) 'Contemporary Cape York Peninsula'. (The Royal Society of Queensland: Brisbane).
1981. Aboriginal people, land rights and wilderness on Cape York Peninsula. *Proceedings of the Royal Society of Queensland* 92: 1-10.
- ROSENFELD, A. 1975. The Early Man sites: Laura 1974. *Australian Institute of Aboriginal Studies Newsletter* 3: 37-40.
1982. Style and meaning in Laura art: a case study in the formal analysis of style in prehistoric art. *Mankind* 13: 199-217.
1984. The identification of animal representations in the art of the Laura region, north Queensland (Australia). Pp. 399-422. In Bandi, H.-G. (ed.) 'La Contribution de la Zoologie et de l'Ethnologie a l'Interpretation de l'Art des Peuples Chasseurs Prehistoriques'. (Editions Universitaires: Fribourg).
- 1988a. Comment. *Rock Art Research* 5: 33-35.
- 1988b. 'Rock Art Conservation in Australia'. (Australian Heritage Commission: Canberra).
1991. Panaramitee: dead or alive? Pp. 136-144. In Bahn, P. and Rosenfeld, A. (eds.) 'Rock Art and Prehistory: Papers Presented to Symposium G of the AURA Congress, Darwin 1988'. (Oxbow Monograph 10: Oxford).
1992. Recent developments in Australian rock art studies. Pp. 231-238. In Laffineur, R. and

- Crowley, J.L. (eds.) 'EIKΩN - Aegean Bronze Age Iconography: Shaping a Methodology'. (Université de Liège: Liège).
- ROSENFELD, A., HORTON, D. & WINTER, J. 1981. 'Early Man in North Queensland'. (Australian National University: Canberra).
- ROSS, A. 1981. Holocene environments and prehistoric site patterning in the Victorian Mallee. *Archaeology in Oceania* 16: 145-154.
1985. Archaeological evidence for population change in the middle to late Holocene in southeastern Australia. *Archaeology in Oceania* 20: 81-89.
- ROSS, A., DONNELLY, T. & WASSON, R. 1992. The peopling of the arid zone: human-environment interactions. Pp. 76-114. In Dodson, J. (ed.) 'The Naive Lands: Prehistory and Environmental Change in Australia and the Southwest Pacific'. (Longman Cheshire: Melbourne).
- ROTH, W.E. 1897. 'Ethnological Studies among the North-West-Central Queensland Aborigines'. (Government Printer: Brisbane).
- 1899a. Report re distribution of gifts to coastal Aborigines. (Unpublished report, Mitchell Library, Sydney).
- 1899b. An account of the Koko Minni Aborigines occupying the country drained by the (middle) Palmer River. (Unpublished report, Mitchell Library, Sydney).
- 1901a. String, and other forms of strand; basketry-, woven bag-, and net-work. 'North Queensland Ethnography Bulletin 1'. (Department of Home Secretary: Brisbane).
- 1901b. The structure of the Koko-Yimdir language. 'North Queensland Ethnography Bulletin 2'. (Department of Home Secretary: Brisbane).
- 1901c. Food: its search, capture and preparation. 'North Queensland Ethnography Bulletin 3'. (Department of Home Secretary: Brisbane).
1902. Games, sport and amusement. 'North Queensland Ethnography Bulletin 4'. (Department of Home Secretary: Brisbane).
- 1903a. Superstition, magic, and medicine. 'North Queensland Ethnography Bulletin 5'. (Department of Home Secretary: Brisbane).
1904. Domestic implements, arts and manufactures. 'North Queensland Ethnography Bulletin 7'. (Department of Public Lands: Brisbane).
1906. Government, morals, and crime. 'North Queensland Ethnography Bulletin 8'. (Department of Home Secretary: Brisbane).
1907. North Queensland Ethnography 9: Burial ceremonies and disposal of the dead. Records of the Australian Museum 6(5): 365-403.
- 1908a. North Queensland Ethnography 10: Marriage ceremonies and infant life. Records of the Australian Museum 7(1): 1-17.
- 1908b. North Queensland Ethnography 11: Miscellaneous Papers. Records of the Australian Museum 7(2): 74-107.
- 1909a. North Queensland Ethnography 12: On certain initiation ceremonies. Records of the Australian Museum 7(3): 166-185.
- 1909b. North Queensland Ethnography 13: Fighting Weapons. Records of the Australian Museum 7(4): 189-211.
- 1910a. North Queensland Ethnography 14: Transport and trade. Records of the Australian Museum 8(1): 1-19.
- 1910b. North Queensland Ethnography 15: Decoration, deformation, clothing. Records of the Australian Museum 8(1): 20-54.
- 1910c. North Queensland Ethnography 16: Huts and shelters. Records of the Australian Museum 8(1): 55-66.
- 1910d. North Queensland Ethnography 17: Postures and abnormalities. Records of the Australian Museum 8(1): 67-78.
- 1910e. North Queensland Ethnography 18: Social and individual nomenclature. Records of the Australian Museum 8(1): 79-106.
- ROTH, W.E. (ed.) 1903b. An elementary grammar of the Nggorikudi language. 'North Queensland Ethnography Bulletin 6'. (Department of Home Secretary: Brisbane).
- ROWLAND, M.J. 1983. Aborigines and environment in Holocene Australia: changing paradigms. *Australian Aboriginal Studies* 1983(2): 62-77.
- ROWLEY, C.D. 1986. 'The Destruction of Aboriginal Society'. (Penguin: Ringwood).
- SACKETT, J.R. 1977. The meaning of style in archaeology: a general model. *American Antiquity* 42: 369-380.
1982. Approaches to style in lithic archaeology. *Journal of Anthropological Archaeology* 1(1): 59-112.
- SARTRE, J.-P. 1968. 'Search for a Method'. (Vintage Books: New York).
- SAUVET, G. & SAUVET, S. 1979. Fonction sémiologique de l'art pariétal animalier franco-cantabrique. *Bulletin de la Société Préhistorique Française* 76: 340-354.
- SAUVET, G., SAUVET, S. & WLODARCZYK, A. 1977. Essai de sémiologie préhistorique (pour une théorie des premiers signes graphiques de l'homme). *Bulletin de la Société Préhistorique Française* 74: 545-558.
- SEATON, D. n.d. Aboriginal rock paintings of north Queensland: Bare Hill area, Cairns hinterland. (Unpublished manuscript, Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra).
- SHANKS, M. & TILLEY, C. 1987. 'Social Theory and Archaeology'. (Polity Press: Oxford).
- SHARP, L. 1934a. The social organisation of the Yir Yoront tribe, Cape York Peninsula. *Oceania* 4(4): 404-431.
- 1934b. Ritual life and economics of the Yir Yoront of Cape York Peninsula. *Oceania* 5: 19-42.
1939. Tribes and totemism in northeastern Australia. *Oceania* 9(3): 254-275, 9(4): 439-461.

- SHEPARD, R.N. 1962. The analysis of proximities: multidimensional scaling with an unknown distance function. *Psychometrika* 27: 125-140, 219-246).
- SMITH, C.E. 1989. Designed Dreaming: assessing the relationship between style, social structure and environment in Aboriginal Australia. (Unpublished B.A. (Hons.) thesis, University of New England, Armidale).
- 1992a. The articulation of style and social structure in Australian Aboriginal art. *Australian Aboriginal Studies* 1992(1): 28-34.
- 1992b. Colonising with style: reviewing the nexus between rock art, territoriality and the colonisation and occupation of Sahul. *Australian Archaeology* 34: 34-42.
- SMITH, M.A. 1986. The antiquity of seed grinding in central Australia. *Archaeology in Oceania* 21: 29-39.
1988. The pattern and timing of prehistoric settlement in central Australia. (Unpublished PhD thesis, University of New England, Armidale).
1989. The case for a resident human population in the Central Australian Ranges during full glacial aridity. *Archaeology in Oceania* 24: 93-105.
- SMITH, M.A. & CUNDY, B.F. 1985. Distribution maps for flaked stone points and backed blades in the Northern Territory. *Australian Aboriginal Studies* 1985(2): 32-37.
- SMITH, P.E.L. & YOUNG, T.C. Jr. 1972. The evolution of early agriculture and culture in greater Mesopotamia: a trial model. Pp. 1-59. In Spooner, B. (ed.) 'Population Growth: Anthropological Implications'. (Massachusetts Institute of Technology: Cambridge).
- SMYTH, R. 1878. 'The Aborigines of Victoria'. (Government Printer: Melbourne).
- SOLOMON, S. & DAVID, B. 1990. Middle Range Theory and actualistic studies: bones and dingoes in Australian Archaeology. Pp. 234-256. In Solomon, S., Davidson, I. and Watson, D. (eds.) 'Problem Solving in Taphonomy: Archaeological and Palaeontological Studies from Europe, Africa and Oceania'. (University of Queensland: Brisbane).
- STANNER, W.E.H. 1989. 'On Aboriginal Religion'. (Sydney University: Sydney).
- STANTON, J.P. & MORGAN, M.G. 1977. Report #1: The rapid selection and appraisal of key and endangered sites - the Queensland case study. (Unpublished report, University of New England, Armidale).
- STEPHENS, K. 1990. A late Quaternary vegetation history from southeast Cape York derived from swamp and archaeological sediments. (Unpublished B. Env. Sci. (Hons.) thesis, University of Wollongong, Wollongong).
- STEPHENS, K. & HEAD, L. 1992. Palaeoecology of archaeological and swamp sites in southeast Cape York Peninsula. (Unpublished report, University of Wollongong, Wollongong).
- STEVENSON, M. 1982. Toward an understanding of site abandonment behaviour: evidence from historic mining camps in the southwest Yukon. *Journal of Anthropological Archaeology* 1(3): 237-265.
- STOKES, J.L. 1846. 'Discoveries in Australia'. (T. & W. Boone: London).
- SUMMERHAYES, G.R. & ALLEN, J. 1993. The transport of Mopir obsidian to late Pleistocene New Ireland. *Archaeology in Oceania* 28(3): 144-148.
- SUTTON, P. 1978. Wik: Aboriginal society, territory and language at Cape Keerweer, Cape York Peninsula, Australia. (Unpublished PhD thesis, University of Queensland, St. Lucia).
- SUTTON, P. & RIGSBY, B. 1982. People with 'Politicks': management of land and personnel on Australia's Cape York Peninsula. Pp. 115-172. In Williams, N. and Hunn, E.S. (eds.) 'Resource Managers: North American and Australian Hunter-Gatherers'. (Australian Institute of Aboriginal Studies: Canberra).
- SUTTON, P., LORBLANCHET, M. & LAYTON, R. 1975. Flinders Island Expedition. *Australian Institute of Aboriginal Studies Newsletter* 3: 34-37.
- SUTTON, S.A. 1990. Pleistocene axes in Sahul: a response to Morwood and Tresize. *Queensland Archaeological Research* 7: 95-109.
- TAÇON, P. 1993. Regionalism in the recent rock art of western Arnhem Land, Northern Territory. *Archaeology in Oceania* 28(3): 112-120.
- TAYLOR, L. 1987. The same but different: social reproduction and innovation in the art of the Kunwinjku of western Arnhem Land. (Unpublished PhD thesis, Australian National University, Canberra).
- THOMAS, N. 1981. Social theory, ecology and epistemology: theoretical issues in Australian prehistory. *Mankind* 13: 165-177.
- THOMSON, D.F. 1972. 'Kinship and Behaviour in North Queensland: A Preliminary Account of Kinship and Social Organisation on Cape York Peninsula'. Australian Institute of Aboriginal Studies: Canberra).
- TINDALE, N.B. 1974. 'Aboriginal Tribes of Australia'. (University of California: Berkeley).
- TORRENCE, R. 1986. 'Production and Exchange of Stone Tools'. (Cambridge University Press: Cambridge).
- TREZISE, P. 1969. 'Quinkan Country'. (Reed: Sydney).
1971. 'Rock Art of Southeast Cape York'. (Australian Institute of Aboriginal Studies: Canberra).
1973. 'Last Days of Wildemess'. (Collins: Brisbane).
1977. Representations of crocodiles in Laura art. Pp. 325-333. In Ucko, P. (ed.) 'Form in Indigenous Art: Schematisation in the Art of Aboriginal Australia and Prehistoric Europe'. (Australian Aboriginal Studies: Canberra).
1987. Comment on J. Flood's 'Rock art of the Koolburra Plateau, north Queensland'. *Rock Art Research* 4(2): 124.

1993. 'Dream Road: a Journey of Discovery'. (Allen & Unwin: St. Leonards).
- ULSANER, E.M. 1978. Editor's Introduction. Pp. 5-6. In Kruskal, J.B. and Wish, M. (eds.) 'Multidimensional Scaling'. (Sage Publications: Beverley Hills).
- VETH, P. 1989. Islands of the interior: a model for the colonization of Australia's arid zone. *Archaeology in Oceania* 24: 81-92.
- WALKER, D. (ed.) 1972. 'Bridge and Barrier: the Natural and Cultural History of Torres Strait'. (Australian National University: Canberra).
- WALSH, G. 1984. Archaeological significance of Flinders Island/Princess Charlotte Bay. (Unpublished report, Queensland National Parks and Wildlife Service, Brisbane).
1985. Flinders Island Group Conservation Project. (Unpublished report, Queensland National Parks and Wildlife Service, Brisbane).
1986. Preliminary report: archaeological sites of the Bare Hill area, Atherton Tableland, north Queensland. (Unpublished report, Queensland National Parks and Wildlife Service, Cairns).
1988. 'Australia's Greatest Rock Art'. (E-J. Brill-R. Brown & Ass.: Bathurst).
1991. Flinders Group National Park site management: regional cultural resource evaluation, preservation and selective presentation in far north Queensland. Pp. 34-44. In Pearson, C. and Swartz, B.K. Jr. (eds.) 'Rock Art and Posterity: Conserving, Managing and Recording Rock Art'. (Australian Rock Art Research Association: Melbourne).
- WALTERS, I. 1984. Gone to the dogs. *Mankind* 14: 389-400.
1987. Another kettle of fish: the prehistoric Moreton Bay fishery. (Unpublished PhD thesis, University of Queensland, St. Lucia).
1989. Intensified fishery production at Moreton Bay, southeast Queensland, in the late Holocene. *Antiquity* 63: 215-224.
- WARD, R.H. & WEISS, K.M. (eds.) 1976. 'The Demographic Evolution of Human Populations'. (Academic Press: London).
- WATCHMAN, A. & COLE, N. 1993. Accelerator radiocarbon dating of plant-fibre binders in rock paintings from northeastern Australia. *Antiquity* 67: 355-58.
- WATCHMAN, A., SIROIS, J. & COLE, N. 1993. Mineralogical examination of Aboriginal rock-painting pigments near Laura, north Queensland. Pp. 141-150. In Fankhauser, B.L. and Bird, J.R. (eds.) 'Archaeometry: Current Australasian Research'. (Australian National University: Canberra).
- WATSON, J. & ABBEY, H.M. 1986. The effects of termites (*Isoptera*) on bone: some archaeological implications. *Sociobiology* 11: 245-254.
- WATSON, J. & FLOOD, J. 1987. Termite and wasp damage to Australian rock art. *Rock Art Research* 4: 17-28.
- WIESSNER, P. 1983. Style and information in Kalahari San projectile points. *American Antiquity* 48(2): 253-276.
- WILLIAMS, E. 1988. 'Complex Hunter-Gatherers: a late Holocene example from Temperate Australia'. (British Archaeological Reports: Oxford).
- WILLIAMS, N. 1982. A boundary is to cross: observations on Yolngu boundaries and permission. Pp. 131-154. In Williams, N. and Hunn, E. (eds.) 'Resource Managers: North American and Australian Hunter-Gatherers'. (Australian Institute of Aboriginal Studies: Canberra).
- WILKINSON, L. 1990. 'SYSTAT: The System for Statistics'. (SYSTAC Inc.: Evanston).
- WOBST, M. 1977. Stylistic behaviour and information exchange. Pp. 317-342. In Cleland, C.E. (ed.) 'Papers for the Director: Research Essays in Honour of James B. Griffin'. (University of Michigan: Michigan).
- WOODROFFE, C.D., CHAPPELL, J. & THOM, B.G. 1988. Shell middens in the context of estuarine development, South Alligator River, Northern Territory. *Archaeology in Oceania* 23(3): 95-103.
- WOOLSTON, F.P. 1965. An excavation in 'Platform Gallery' near Cooktown, north Queensland. (Unpublished report, Australian Institute of Aboriginal Studies, Canberra).
- WOOLSTON, F.P. & TREZISE, P. 1969. Petroglyphs of Cape York Peninsula. *Mankind* 7: 120-127.
- WRIGHT, R.V.S. 1971. Prehistory in the Cape York Peninsula. Pp. 133-40. In Mulvaney, D.J. and Golson, J. (eds.) 'Aboriginal Man and Environment in Australia'. (Australian National University Press: Canberra).
1992. Correlation between cranial form and geography in *Homo sapiens*: CRANID - a computer program for forensic and other applications. *Archaeology in Oceania* 27(3): 128-134.
- WUNDERLY, J. 1943. The Keilor fossil skull: anatomical description. *Memoirs of the National Museum* 13: 57-70.
- YENGOYAN, A.A. 1976. Structure, event and ecology in Aboriginal Australia: a comparative viewpoint. Pp. 121-132. In Peterson, N. (ed.) 'Tribes and Boundaries in Australia'. (Australian Institute of Aboriginal Studies: Canberra).
- YOFFEE, N. 1985. Perspectives on 'trends towards social complexity in prehistoric Australia and Papua New Guinea'. *Archaeology in Oceania* 20(2): 41-48.

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